

# SURVEY OF SPORT FISHERY PROJECTS, 1956



**CIRCULAR 46**

**FISH AND WILDLIFE SERVICE**

**UNITED STATES DEPARTMENT OF THE INTERIOR**



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## CIRCULAR 46

Compiled in the Branch of Federal Aid

FISH AND WILDLIFE SERVICE  
UNITED STATES DEPARTMENT OF THE INTERIOR



Washington, D. C. - January 1957

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PURPOSE AND DESCRIPTION OF THE SURVEY

This circular is the third catalog of sport-fishery programs in the United States. Its objective is to provide fishery administrators, teachers, research workers, and managers a means of keeping abreast of current work in fish conservation and restoration activities. It is believed that the publication will stimulate a greater exchange of ideas among those engaged in similar projects, will aid in preventing needless duplication of effort, and will furnish a comprehensive picture of our sport-fishery programs.

The Survey is a cooperative venture which deals primarily with work in progress. Past accomplishments or future plans have been included only when they were directly related to current work. Because of space limitations it was necessary to exclude reports on fish stocking, law enforcement, public relations, and similar routine management operations.

Reports on individual projects are necessarily brief, and the space assigned does not reflect the importance of a project. So far as possible, the Fish and Wildlife Service has limited its editing of completed questionnaires to the standardization of format and attainment of clarity. The Service serves only as a clearing-house and means of publication. Readers desiring additional information are requested to direct inquiries to the responsible agency as given under the project description rather than to the Fish and Wildlife Service, except where the project is listed as an undertaking of the Service.

Since there is no complete directory of agencies and institutions engaged in projects covered by the Survey, undoubtedly some have been overlooked. Readers knowing of such omissions are urged to notify the Fish and Wildlife Service, so that the omitted agency may have opportunity to provide reports for

the next edition. Annual changes in fishery programs are not sufficient to warrant publication of the Survey every year. Therefore, an edition was not published for 1955. The issuance of future editions will depend on the need for bringing the listing of projects up to date and on the expressed desires of cooperators.

### EXPLANATION OF PROJECT DESCRIPTIONS

Material reported by the several game and fish departments, universities, and Federal and private agencies, is arranged in the following order:

1. Title of project.
2. Objectives and description.
3. General explanator information:
  - a. Cooperating agencies.
  - b. Area covered and/or location of headquarters.
  - c. Date project began and expected completion date.
  - d. Estimated cost of current segment.
  - e. Name of the leader.
  - f. Availability of reports.
4. Person or office to receive inquiries concerning further details and accomplishments.

The cost figure, when given, is that reported for the current year or segment and does not represent the entire cost of a project with a life of more than one year. If the reporting agency stated that reports on the project, or phases thereof, are available, this is indicated. For information on the availability of reports on Fish and Wildlife Service projects write to the person indicated in that particular project.

### SUMMARY OF LISTINGS BY AGENCY TYPE

The broad scope of projects listed in the Survey reflects the attention being given our sport-fishery resources by many agencies. On the basis of numbers alone, leading contributors are the State fish and game departments, colleges and universities are second, and Federal agencies are third. Since the cost of many projects is not given, it is impossible to present a summary of the amount of money being spent by the various agencies. This can usually be obtained from annual or biennial reports and other special publications.

Reported by--	Number of Agencies	Projects
State Conservation Agencies:		
Fish and Game Departments. . . . .	48	491
Other . . . . .	8	14
Colleges and Universities . . . . .	32	129
Federal Agencies:		
Fish and Wildlife Service. . . . .	4	84
Public Health Service . . . . .	1	1
Forest Service. . . . .	1	2
TVA. . . . .	1	4
Territories . . . . .	4	21
Industrial Corporations . . . . .	2	2
Totals	101	748

## ALABAMA

### Department of Conservation

#### 1. Fish Population Studies in Rivers and Large Impoundments

The objectives are: (1) To determine the species composition of fish in the various rivers and impoundments of the State. (2) To determine the effects of pollution. (3) To obtain some idea of the production of fish in various waters.

Alabama Polytechnic Institute and Tennessee Valley Authority cooperating; statewide; began 1948, continuing; \$5,000; I. B. Byrd, H. S. Swingle and Lawrence Miller, Leaders; reports available.

Address inquiries to: I. B. Byrd, Alabama Department of Conservation, Montgomery, Alabama.

#### 2. Farm Ponds Investigations in Alabama

The objectives are: (1) To determine whether 100, 125, or 150 bass per acre was the best stocking rate for fertilized ponds that were stocked with 1,000 bream per acre. (2) To determine the major factors or conditions that caused unsuccessful or unbalanced ponds.

Cullman, Montgomery and Pike Counties; began October 1952 closed October 1956; \$2,000; D. D. Moss, Leader; reports available.

Address inquiries to: D. D. Moss, Department of Conservation, Montgomery Alabama.

#### 3. Construction of Public Fishing Lakes

Public fishing lakes are constructed in those areas of the State having insufficient fishing waters. These lakes are fertilized and managed to obtain maximum production of fish. They are designated as minor state parks and, in addition to fishing, provide swimming, picnicking, and boating.

Statewide; began 1948, continuing; \$150,000; I. B. Byrd, Leader; reports available.

Address inquiries to: I. B. Byrd, as in No. 1 above.

### Alabama Polytechnic Institute

#### 1. Survey of Parasites of Pondfish in Alabama and Their Control

A study of prevalence of fish parasites in Alabama and their control in ponds.

Auburn; began July 1956; \$6,460; Henry F. Turner, Leader.

Address inquiries to: Henry F. Turner, Fisheries Building, Auburn, Alabama.

#### 2. Stream and Impoundment Surveys

Survey of fish populations in rivers, streams, and impoundments including effects of pollution.

Department of Conservation cooperating; statewide; began 1950; \$6,000; H. S. Swingle and I. B. Byrd, Leaders.

Address inquiries to: H. S. Swingle, Auburn, Alabama.

#### 3. Farm Ponds

Management of ponds for production of sport fishing. Species and species combinations giving highest production, methods of stocking, effect of rates of fishing, methods of fertilization, and related problems are investigated. Commercial production of fish for food in ponds is also being studied.

Auburn; began 1933, continuing; \$20,000; H. S. Swingle and E. E. Prather, Leaders.

Address inquiries to: H. S. Swingle, Auburn, Alabama.

4. The Invertebrate Animals Serving as Food for Fish in Alabama Ponds

The objectives are to determine the species, seasonal cycles of abundance, utilization, and ecology of the invertebrate animals that serve as food for fish in ponds in Alabama. Aquatic animals from a wide variety of habitats in ponds will be collected for species identification. Samples of food organisms will be collected throughout the seasons to determine seasonal cycles of abundance. Contents of stomachs of fish will be analyzed to determine utilization of different organisms. Relations of food organisms to their environment will involve studies of habitats by measuring depth, temperature, and dissolved oxygen content of the water, and by determining the nature of the substrata and the degree of interspecific cohabitation.

Auburn; began July 1956, to close June 1961; \$2,600; J. S. Dendy, Leader.

Address inquiries to: J. S. Dendy, Fisheries Lab., A. P. I., Auburn, Alabama.

5. Minnow Production

The objectives are: (A) To determine the species of fish that can be produced most profitably for bait. (B) To determine the most efficient supplemental feeds and rates of feeding for bait fish. (C) To determine the most desirable methods for harvesting, handling, temporary storage, and transportation for bait fish.

Auburn; began 1946, to close 1960; \$15,000; E. E. Prather, Leader; reports available.

Address inquiries to: E. E. Prather, A. P. I. Agricultural Experiment Station, Auburn, Alabama.

6. Chemical Control of Weeds in Ponds

The objectives are: (1) To test the effectiveness of commercial and experimental herbicides and algacides on common pond weeds of this area. (2) To determine the toxicity of commercial and experimental herbicides and algacides to fish and fish food organisms, and their effects in ponds on fish production, plankton production, and bottom organisms production.

Auburn; began July 1956, to close June 1961; \$10,000; J. M. Lawrence, Leader.

Address inquiries to: J. M. Lawrence, Fisheries Building, A. P. I., Auburn, Alabama.

U. S. Fish and Wildlife Service, Branch of Game-fish and Hatcheries

1. Warm-water Pond Fish Culture

Existing methods of producing warm-water species of pond fishes under hatchery conditions are critically examined with the objective of improving present procedures and techniques in hatchery management. Production methods for warm-water species of fish which show promise of improving the quality and quantity of the hatchery output are tested. Studies are being conducted on methods of fertilization, vegetation control, and other pond management techniques under hatchery conditions.

Marion; began January 1950, continuing; Jack R. Snow, Leader.

Address inquiries to: Jack R. Snow, U. S. Fish Cultural Station, Marion, Alabama.

## ARIZONA

### Game and Fish Department

#### 1. Fisheries Investigation of Region I

The objective is to introduce and determine usage of threadfin shad by other fish and the result upon the fisherman's catch. Fishing pressure on warm water fish of Lake Mohave and on trout below Hoover and Davis Dams by residents and nonresidents, the most economical size classes of trout stocked, and the best time of the year for stocking in terms of return to the fisherman's creel are also determined.

The project leader and two assistants are making a comparative creel census of the areas to be covered and are collecting stomach samples, scales, and length data. Fin clipped and tagged trout are planted.

Lake Mohave and Colorado River; began January 1956, to close January 1957; \$20,000; Roger Gruenewald, Leader; reports available.

Address inquiries to: A. W. Yoder, Chief of Fisheries, Game and Fish Department, Capitol Annex, Phoenix, Arizona.

### U. S. Fish and Wildlife Service, Branch of Game-fish and Hatcheries

#### 1. Creel Study

The purpose of the project is to determine the return of stocked rainbow trout to anglers. Information obtained includes catch per man-hour, fishing pressure, and creel composition. Stocked fish are marked. A comparison of fishing with and without stocking will be made.

Recreational Enterprise White Mountain Tribe, Office of Indian Affairs cooperating; Fort Apache Indian Reservation; began June 1956, closed October 1956; \$1500; Joe Huston, Leader.

Address inquiries to: Regional Director, U. S. Fish and Wildlife Service, P. O. Box 1306, Albuquerque, New Mexico.

## ARKANSAS

### Game and Fish Commission

#### 1. A Comparative Fisheries Study

This is a comparison of the physical, chemical, and biological features of Lakes Catherine, Hamilton, and Ouachita. These impoundments are located on the upper reaches of the Ouachita River and are very similar except for age. Fishing success seems to be directly affected by the age of the impoundment with the newer impoundments providing the best fishing. The purpose of the project is to produce a management plan which will improve fishing in the older impoundments and maintain good fishing in the newer impoundments.

West-central Arkansas; began June 1955, to close September 1958; \$9,300; James Stevenson, Leader.

Address inquiries to: James Stevenson, 2009 IZard Street, Little Rock, Arkansas.

#### 2. Tailwater Trout Studies

Survey and development of a trout fishery in Arkansas below Norfork Dam on the North Fork River and below Bull Shoals Dam on the White River in North Arkansas.

White and North Fork Rivers; began June 1955, to close June 1958; \$20,500; Robert Baker, Leader.

Address inquiries to: Andrew H. Hulsey, Asst. Fed. Aid Coordinator, Fisheries, Lonoke, Arkansas.

## ARKANSAS (Cont. )

### 3. Lake Atkins Development Project

The objective is to construct a 752-acre sport fishing lake and provide for public access.

West-central Arkansas; began July 1955, closed December 1956; \$124,000; John Buxton, Leader.

Address inquiries to: Andrew H. Hulsey, as in No. 2 above.

### 4. Statewide Fisheries Survey

The objectives are: (1) To locate and catalogue the State's public fishing waters. (2) To record the distribution of the principal gamefish and provide data on success of reproduction, survival, growth, and age. (3) To provide recommendations for management and evaluation of the results of management.

Statewide; began July 1951, to close July 1958; \$23,000; Leroy Gray, Leader; reports available.

Address inquiries to: Leroy Gray, P. O. Box 301, Hazen, Arkansas.

### 5. Experimental Channel Catfish and Buffalofish Culture and Propagation

The objective is to develop practical methods for the culture and propagation of channel catfish and buffalo in warm water hatchery ponds. There is a possibility that rice field reservoirs can be used for commercial production of these species.

Centerton and Lonoke Fish Hatcheries; began January 1952; Bruce Crawford and Lee Brady, Leaders; reports available.

Address inquiries to: Joe Hogan, Supervisor of Fisheries, Lonoke, Arkansas.

### 6. Experimental Drawdown Management on Flood Control Lakes

The objectives are: (1) to benefit the sport fishery by balancing the fish population, (2) to control colloidal turbidity, and (3) to aid in the harvest of commercial and sport fish species.

U. S. Fish and Wildlife Service and U. S. Army Engineers cooperating; Nimrod and Blue Mountain Lakes; began October 1955, to close October 1958; Andrew H. Hulsey, Leader; reports available.

Address inquiries to: Andrew H. Hulsey, as in No. 2 above.

## CALIFORNIA

### Department of Fish and Game

#### 1. Statewide Warmwater Fish Research Program

The objectives of the project include: (a) A study of forage fish introductions to find more suitable species for fluctuating water level reservoirs. This is now centered around the evaluation of the threadfin shad. (b) An investigation of population dynamics of warmwater streams, lakes, and reservoirs in terms of production, fishing and natural mortality, and growth. Principle species are the largemouth and smallmouth black bass, sunfishes such as the bluegill and redear, black and white crappie, and catfish. (c) A catfish study to provide adequate information concerning fishing pressure and life history data necessary for the management of California's catfish resources. Several thousand catfish have been tagged to furnish data relative to rate of exploitation and migratory tendencies. Samples are collected for study of age and growth, food habits, and reproductive characteristics. This work was formerly carried on under Dingell-Johnson Project F-2-R, A Study of the Catfish Fishery of California.

Statewide; began March 1953, continuing; \$22,000; J. B. Kimsey, Leader; reports available.

Address inquiries to: Inland Fisheries Branch, California Department of Fish and Game, 722 Capitol Avenue, Sacramento 14, California.

2. Water Projects Investigations

The principal objective of the project is to provide for future fisheries, wildlife, and recreation in connection with water projects to be constructed in the State of California. Project personnel work directly with the personnel of the State's water development planning agency, and report on the recreational aspects of all proposed water projects.

Information is gathered on fish and game populations, factors influencing their success and development, and characteristics of their present utilization. Factors reported on typically consist of fish protective devices and methods, flow requirements of downstream fisheries, and economic evaluations of fisheries and wildlife, both with projects and without them.

California Department of Water Resources cooperating; statewide; began March 1953, indefinite; \$40,000; David E. Pelgen, Leader; reports available.

Address inquiries to: Robert M. Paul, Water Projects Coordinator, Water Projects Section, California Department of Fish and Game, 722 Capitol Avenue, Sacramento 14, California.

3. Hatchery Trout Feeding Experiments

These experiments are designed to test and develop dry foods for trout that will maintain the health and rapid growth now achieved with the use of liver and ocean fish. It is generally conceded that improved conversion rates are possible with dry foods. This could lead to a considerable savings in the cost of freight, handling, storage, and preparation, thereby lowering production costs.

Results thus far are inconclusive. Certain commercial pellets have been tested extensively. Excellent results have been achieved at some hatcheries with complete failure at others. The variables are many, but further trials are warranted.

Statewide; began May 1954, indefinite; \$4,000; Robert Macklin, Leader; reports available.

Address inquiries to: As in No. 1 above.

4. Freshwater Fish Disease Investigations

This project is chiefly concerned with examination, diagnosis, and treatment of diseases in California hatcheries. Inspection of commercially and state-reared trout is also carried out in order to prevent the planting of diseased fish in California waters. The major effort in disease research involves a study of the life cycle of a blood fluke found in trout and control methods. Observations are also being made on trout strain resistance to parasitic copepods.

Statewide; continuing; \$15,000; Harold Wolf and J. H. Wales, Leader; reports available.

Address inquiries to: As in No. 1 above.

5. Economic Survey of Sport Fishing in California

The objective of this project is to determine the monetary value of all types of sport fishing in California during 1955. Questionnaires were sent to a selected sample of California anglers to obtain the data. Several expense categories were established including transportation costs; lodging; oil and gas for boat motors; rentals of motors, boats, horses, camping gear, etc.; bait; fishing equipment; general purpose supplies and equipment, such as

boots and waders; and repair and maintenance of equipment used for fishing. The questionnaire was designed to enable a breakdown of expenditures between saltwater and freshwater sport fishing. Costs per angler-day will provide the basis for determining total expenditures by sport fishermen.

An electronic calculator is being used to process the raw data.

Hdqtrs. Sacramento; began January 1956, indefinite; \$2,000; John J. Mahoney, Leader.

Address inquiries to: As in No. 1 above.

6. Sport Live Bait Fishery of Southern California

The objectives are to determine:

1. The total annual catch for California waters and the percentage contribution of each major sportfishing port.
2. The species composition of the bait for each port.
3. The age composition of the major bait fish, Engraulis mordax.
4. Fluctuations in total bait abundance as reflected by catch per unit effort.

Bait samples and fishermen interviews are taken from nine Southern California sportfishing ports each week and brought into the laboratory for analysis. The data are compiled on a monthly and annual basis for each port.

Southern California; began April 1955, continuing; \$2,500; David C. Joseph, Leader; reports available.

Address inquiries to: George Reiner, Department of Fish and Game, State Fisheries Laboratory, Terminal Island Station, San Pedro, California.

7. Marine Sportfishing Investigation

This project uses daily catch records from several hundred commercial sportfishing boats to determine the population fluctuations of approximately a dozen sport fishes. Wherever the statistical picture indicates a need for biological information, this work is mapped out. Through both the statistical and biological mediums, conservation regulations, actual or planned, can be critically evaluated. Marine fields closely related to marine sportfishing are kept under surveillance, and practical suggestions are advanced to prevent conflicts where possible.

Coastal California; began 1936, indefinite; \$17,000; Parke H. Young, Leader; reports available.

Address inquiries to: California State Fisheries Laboratory, Terminal Island Station, San Pedro, California.

8. Albacore Investigation

This project consists of:

- (A) A study of variation in time and location of the most productive fishing areas by means of a log book program and to possibly explain this variation by examining the oceanographic environment.
- (B) Collection of a series of length-frequency samples of the catch to determine growth rates and to measure the available abundance and relative importance of different size groups to the fishery.
- (C) Development of a method to age albacore to determine the age composition of the catch.
- (D) Determination of migration patterns and rates of growth by means of tagging.
- (E) Development of new fishing areas and techniques by conducting exploratory activities on Department vessels.

Oregon Fish Commission and Washington Department of Fish and Game cooperating; Eastern Pacific Ocean from Central Baja California north and from the coast offshore several hundred miles; began June 1951, indefinite;

\$25,000; Leo Pinkas, Leader; reports available.

Address inquiries to: California Department of Fish and Game, Marine Fisheries Branch, 511 Tuna Street, Terminal Island, California.

9. Ocean Salmon Sportfishery Investigation

The primary objectives of this project are to obtain reliable estimates of the number of king and silver salmon landed by the off-shore sportfishery; to estimate the annual value of this fishery to the State; to determine age and size composition of the catch; and to evaluate the effect of present regulations in regard to efficient utilization of the resources. Intensive creel censuses are being conducted at the several areas where the sportfishery is concentrated.

Secondary objectives of this project are to estimate the numerical size of each major river's spawning population; to determine size, sex composition, and spawning success of individuals in these populations; to establish optimum numerical size of each watershed's population; and to keep account of conditions inimical to salmon.

Central and Northern California coast; began July 1954, indefinite; \$22,000; H. H. McCully, Leader; reports available.

Address inquiries to: Marine Fisheries Branch, California Department of Fish and Game, Museum Building, Stanford, California.

10. Surf Fishing Investigation

Four surf species, the corbina, the spotfin and yellowfin croakers, and the barred perch are under study to evaluate the fishery and study pertinent life histories and make recommendations for management. Statistics are obtained from surf fishermen's voluntary records and from surveys and creel censuses. These data are the basis of a statistical analysis by species, area, time interval, and catch per unit of effort as well as importance of each species.

Fish for biological studies and tagging are obtained by beach seine, drag net, and gill net. Observations are made by aqua lung diving. Biological studies include age and rate of growth, food habits, maturity and fecundity, and spawning.

Coast of Southern California; began March 1952, to close April 1958; \$26,000; John G. Carlisle, Jr., Leader; reports available.

Address inquiries to: John G. Carlisle, Jr., California State Fisheries Laboratory, Terminal Island Station, San Pedro, California.

11. Yellowtail Study

Yellowtail, a fish of considerable recreational value, heavily exploited by Southern California anglers at the northern extremity of its range, are being studied to determine what can be done to maintain the best possible fishing. Through tagging, the contribution of Baja California fish to California is being sought. Plastic tubing tags, developed in cooperation with the Department of Fish and Game tuna investigation, have been highly satisfactory. Anesthetizing yellowtail for easier handling was tried with very promising results. Studies of age, rate of growth, maturity and fecundity are in progress. Commercial catch statistics have been kept.

Southern California and Baja California; began January 1952, to close June 1957; \$35,000; Robert D. Collyer, Leader; reports available.

Address inquiries to: As in No. 7 above.

12. Coastal Streams Anadromous Trout and Salmon Study

The current objectives of this project are: (a) To determine the survival to the angler's catch and to spawning of artificially propagated steelhead. (b) To determine the survival to the angler's catch and to spawning of naturally reproduced steelhead under varying conditions such as controlled numbers of spawning fish and/or controlled water flows. (c) To measure the reasons for, and extent of, mortality occurring to these different kinds of fish while they are in freshwater, and to test ways of reducing this mortality. (d) To test the effects of various management methods, including physical and biological habitat improvement and regulations on these fish and the fisheries for them. (e) To provide information needed for evaluating the effects of proposed and existing water developments on salmon and steelhead in the project area.

Statewide; began February 1955, indefinite; \$38,500; Leo Shapovalov, Leader; reports available.

Address inquiries to: As in No. 1 above.

13. A Study of Sturgeon and Striped Bass

Sturgeon: Life history studies include determination of the statewide distribution, migration patterns, age at sexual maturity, fecundity, place and frequency of spawning, and age-length-weight relationship by sexes. The pectoral fin ray method of aging is being validated. Estimates of harvest are obtained from tag returns.

Striped Bass: Activities involve the determination of angler harvest through tagging studies and maintenance of a continuous system of party boat catch records. The annual sampling of fry on the spawning grounds is intended to show spawning success and to be correlated with later year class success. The effect of the salmon and shad commercial fishery on the species is being evaluated. Problems of sampling for mortality studies and the effect of environmental changes are being investigated.

Statewide; began July 1954, continuing; \$17,000; J. B. Kimsey, Leader; reports available.

Address inquiries to: As in No. 1 above.

14. Trout Management Study

This study was set up to integrate all basic research being conducted on trout by the Department. Current work of this project is aimed toward the following objectives: (a) To develop a means of evaluating the results of catchable trout stocking. Tests involving tagged and marked trout have been carried out at various waters throughout the State. A subcutaneous tag has been developed and used with a great deal of success. (b) To determine the species of trout or the strains within species that are the most suitable for various California waters. Several different strains of rainbow trout and three different strains of brown trout are being studied in selected test waters, which include Castle Lake, Rush Creek, and several lakes in the Lakes Basin Recreation area in Sierra and Plumas Counties. The eastern brook and "splake" trout are also being compared with each other, as well as with various strains of browns and rainbows in mountain lakes lying between 5,000 and 7,000 feet elevation. Considerable differences in catchability, as well as other factors, have been found to exist among strains of the same species. (c) To decrease the mortality and improve the health and vitality of trout through the control of disease.

Statewide; began October 1953, continuing; \$55,000; E. D. Bailey, Leader; reports available.

Address inquiries to: As in No. 1 above.

15. Sacramento-San Joaquin River Salmon and Steelhead Study

This study has two objectives: first, to estimate and evaluate losses in irrigation diversions of seaward migrant salmon and steelhead; second, to study the steelhead and its fishery in the Sacramento River to determine if it is economically feasible to improve steelhead angling in this river system by stocking yearling hatchery fish. Creel census, trapping, and the examination of fish at a fish ladder on Mill Creek and at Coleman Hatchery on Battle Creek are being done to determine the contribution of the marked hatchery fish. During 1956, a total of 270,500 yearling steelhead were marked and released. Tagging studies, in conjunction with the marking experiments, are making it possible to determine the number of adult steelhead migrating into the upper Sacramento River, the number taken by anglers, and the proportion of hatchery fish in the population as well as the catch.

U. S. Fish and Wildlife Service, California Kamloops, Inc., and Steelhead Unlimited cooperating; Sacramento-San Joaquin Valleys; began October 1952, to close June 1959; \$45,000; Leo Shapovalov, Leader; reports available.

Address inquiries to: As in No. 1 above.

16. Stream and Lake Improvement

The objective of this project is to improve lakes and streams in order to increase the production and/or utilization of game fish. Some of the methods used to achieve the objective include fish population control through use of fish toxicants and other means; removal of log and debris jams acting as barriers to migrating fish; construction of pool-creating devices in streams; and control of excessive aquatic vegetation by chemical, mechanical, or other means.

Considerable time has been spent testing the new weedicides under various California conditions and where various species of game fishes are present.

Statewide; began March 1952, continuing; \$50,000; E. D. Bailey, Leader; reports available.

Address inquiries to: As in No. 1 above.

Stanford University, Department of Biological Sciences

1. Metabolism Rate Variations of Bluegill Sunfish

The objectives are: (1) To determine the effect of body weight, temperature, and activity on the rate of oxygen consumption. (2) To determine if seasonal rates of oxygen consumption vary for given body weights, temperatures, and activities. (3) To explain, if possible, late summer weight losses of larger fish and stunting of smaller fish at a time when food appears in short supply on the basis of metabolism rates.

Felt Lake, Stanford University Campus; began March 1956, to close June 1957; Rogelio Juliano, Leader.

Address inquiries to: Donald E. Wohlschlag, Natural History Museum, Stanford University, California.

2. Seasonal Environmental Effects on the Population Dynamics of a Natural Predator-Prey Relationship

The objectives are: (1) To determine the quantitative seasonal changes in rates of recruitment, growth, and death, and also changes in population size of a predator-prey fish combination (largemouth bass and bluegill) over a period of three years. (2) To evaluate rates of change of biological production. (3) To ascertain the possible magnitude and extent of causal environmental factors influencing seasonal and annual changes in population statistics. (4) To examine existing mathematical population models and relate them, with modifications if necessary, to actual conditions of existence.

## CALIFORNIA (Cont. )

National Science Foundation cooperating; Felt Lake, Stanford University Campus; began February 1955, to close July 1958; Donald E. Wohlschlag, Leader.

Address inquiries to: As in No. 1 above.

### 3. Seasonal Changes in Growth Rates of Bluegill Sunfish in a Fluctuating Reservoir

The objectives are: (1) To determine the amounts of growth which bluegills of various sizes and ages experience during different seasons of the year. (2) To determine, if possible, the extent to which spring and late summer spawned fish contribute to the larger size groups.

National Science Foundation cooperating; Felt Lake, Stanford University Campus; began February 1955, closed December 1956; Paul M. Bruns, Leader.

Address inquiries to: As in No. 1 above.

## University of California

### 1. Sagehen Creek Project

Long-term ecological studies of the distribution and abundance of fish populations in Sagehen Creek were started in 1951. These involve pumping and draining 10 sections of stream each season to follow cycles in trout populations.

Allied studies are (1) Beaver-trout relationships by Richard Gard. (2) Creel census to determine exploitation rates of naturally propagated trout. (3) Studies of the effects of winter conditions on survival of trout, including the factors of ground water, anchor ice, frazil ice, shelf ice, and snow. (4) Beaver food supplies by Joe Hall, completed in June 1956.

Tahoe National Forest; began June 1951, indefinite; \$10,000; P. R. Needham and Richard Gard, Leaders.

Address inquiries to: Paul R. Needham, Department of Zoology - Fisheries, University of California, Berkeley 4, California.

## U. S. Fish and Wildlife Service, Branch of Fishery Biology

### 1. Survival and Vitality of Hatchery-reared Trout in Streams

The objectives of this project are to assess the survival and physical vitality of rainbow trout hatched and reared at several hatcheries and tested under a variety of controlled outdoor and laboratory conditions, and to determine the factor or factors in the hatcheries and in the field that limit their survival.

California Department of Fish and Game and Nevada Fish and Game Commission cooperating; Convict Creek Experiment Station; began July 1956, indefinite; \$13,000; Reed S. Nielson, Leader; reports available.

Address inquiries to: Reed S. Nielson, U. S. Fish and Wildlife Service, 118 West 2nd Street, Room 26, Reno, Nevada.

### 2. Productivity of High Sierra Lakes

The objective of this project is to investigate the relationship between physicochemical influences and biological productivity and to develop new field and laboratory methods and techniques for the assessment of lake productivity.

California Department of Fish and Game and Nevada Fish and Game Commission cooperating; Convict Creek Basin; began July 1953, indefinite; \$13,000; Norman Reimers, Leader; reports available.

Address inquiries to: Reed S. Nielson, as in No. 1 above.

U. S. Fish and Wildlife Service, River Basin Studies

1. Northwestern California Coastal Streams

This project was initiated to make basin wide surveys of the fish populations in the several streams of the north coast of California where water developments are proposed. The investigations have concentrated on the abundance and time of upstream and downstream movement of salmon and steelhead trout.

California Department of Fish and Game and the U. S. Bureau of Reclamation cooperating; Eel and Klamath Rivers; began June 1954, indefinite; \$39,000; Warren H. Nord, Leader.

Address inquiries to: Regional Director, U. S. Fish and Wildlife Service, P. O. Box 3737, Portland 8, Oregon.

COLORADO

Game and Fish Department

1. Mosquito Lake Studies

Mosquito Lake has an area of about two acres, depth of ten feet, and is located on Grand Mesa at an elevation of approximately 10,000 feet. The lake is accessible by road and in an area of heavy trout fishing use. It had previously been established that the lake winter-kills. Three different plants of marked creel-size trout were made at different times during the 1956 fishing season. A partial creel census was conducted. An accurate determination of the fish population in the lake was obtained at the end of the 1956 fishing season. Data were obtained on the most suitable planting dates. Experiments were conducted to determine the value of underwater lights as a means of estimating the trout population.

Delta County; began June 1956, to close April 1957; \$500; P. T. Barrows, Leader.

Address inquiries to: Colorado Game and Fish Department, 1530 Sherman, Denver, Colorado.

2. Parvin Lake Studies

This is a 6-year study of a heavily fished lake in northern Colorado. A complete creel census of all fishermen was obtained during 5 of these years. Thus, it was possible to obtain complete information on the various experimental plants of trout made during this time. Various species, sizes, and numbers of trout were planted at varying times of the year and their subsequent growth and survival followed. In addition, pertinent information was kept on the fishermen and their methods. Some limnological data was collected on the lake. (60 acres, elevation 8,200 ft.) During this study period, yellow perch became established in the lake and were very abundant by 1955. The study was terminated in October 1955 by draining the lake, both to remove the perch and to estimate the surviving trout population.

Larimer County; began May 1949, closed October 1956; \$5,000; W. C. Nelson, Leader; reports available.

Address inquiries to: As in No. 1 above.

3. Island and Eggleston Lakes Investigations

The objectives are to determine the effectiveness of plants of marked 2-inch hatchery-reared rainbow trout made in lakes of this type, and to compare the returns to the creel and growth of the 2-inch plants with returns

of identifiable plants of creel-size hatchery trout planted in the same lakes. The various plants of trout were marked and a partial creel census was conducted to obtain desired data on return to the creel and growth of the fish. Limited limnological data was collected as a part of the study.

Delta County; began 1953, to close 1957; \$2,000; P. T. Barrows, Leader; reports available.

Address inquiries to: As in No. 1 above.

4. Channel Catfish Inventory and Transplanting Operation

The objectives are to determine the abundance of channel catfish available in western Colorado streams and to crop off as many fish as possible where they are most numerous for transplanting in other waters of the State. A fish toxicant will be used to collect the fish. Some success has been obtained by applying fish toxicants to the streams in small quantities, rescuing the fish and placing them in clean water for recovery.

Dolores and San Juan Rivers; began August 1956, closed December 1956; \$1,250; T. M. Lynch, Leader; reports available.

Address inquiries to: T. M. Lynch, Colorado Game and Fish Department, 1530 Sherman Street, Denver, Colorado.

5. Exotic Fish Inventory

The objective is to determine the survival, growth, and reproductive success of walleye, white bass, drum, northern pike, and redear sunfish which have been planted in Colorado waters during the past few years.

The possibilities of establishing an artificial spawn taking program for walleyes at Bonny Reservoir, Yuma County, are investigated also.

Statewide; began January 1956, closed December 1956; \$5,280; Robert Jones and Donald Nolting, Leaders; reports available.

Address inquiries to: T. M. Lynch, as in No. 4 above.

6. Experimental Use of Fingerling Rainbow Trout in Streams

The objective is to obtain data on the survival and growth of plants of hatchery-reared 2-inch rainbow trout made in stream sections where previous census had shown naturally produced trout to be scarce or absent. An electrical shocking device was used to inventory the trout population in a number of Colorado streams. In three locations where naturally produced fingerling trout were absent or scarce, plants of marked hatchery-reared rainbow trout were made. Follow-up inventories by means of an electrical shocking device made in the fall of the year of the plant (fish were planted in June or July) and in the spring and fall of the following year provided information on the growth and survival of the 2-inch marked fish. The work was regarded as preliminary in nature. Depending on the results obtained, further experimental work using fingerling trout in streams was to be conducted.

Williams Fork, Eagle River, and Colorado River; began June 1954, closed July 1956; \$200; W. D. Klein, Leader.

Address inquiries to: W. D. Klein, Colorado Game and Fish Department, 1530 Sherman, Denver, Colorado.

7. The Development of New Fishing Lakes

The objective is to develop additional good fishing lakes available for free public fishing. Practically all of Colorado's Dingell-Johnson funds are spent on lake development projects. Suitable sites on Federal lands in the mountainous sections of the state offer the best possibilities for development and have been used extensively to date. Prior water commitments of various types (interstate compacts, local domestic and irrigation rights, etc.) offer many

problems in connection with the Colorado Lake development program. State funds are used to expand the program over what the Dingell-Johnson funds alone will permit. Approximately 1,000 acres of additional fishing water will have been developed by the end of 1957.

Statewide; began 1951, continuing; \$200,000; reports available.

Address inquiries to: As in No. 1 above.

8. Rawah-MacIntyre High Lakes Studies

The objective of this cooperative 3-year project is to evaluate the effects of fertilization on the trout populations of some Colorado mountain lakes. Six lakes are intensively studied, the investigational activities including fish population sampling, limnological studies, and population estimates. In the future food and feeding relationships will be added to the project and will involve the use of a radioactive isotope of phosphorous.

Colorado A and M College cooperating; Roosevelt National Forest, Larimer County; began June 1956, to close October 1958; \$3,000; Wesley C. Nelson, Leader; reports available.

Address inquiries to: Wesley C. Nelson, Colorado Game and Fish Department, 1530 Sherman Street, Denver 3, Colorado.

9. Skaguay Reservoir Studies

Detailed information is obtained on the fish and fishermen as well as for pertinent physical, biological, and ecological conditions in a fluctuating water reservoir as a basis for better fish management in waters of this type. The Skaguay study involves experimental plants of marked kokanee salmon and rainbow trout. Growth, returns, and spawning observations are recorded. All available means of sucker control are practiced and the results recorded. All fishermen are checked both in and out, all fish measured and other pertinent data recorded. Since the reservoir has only one access road an almost 100 percent creel census is obtained.

Teller County; began May 1952, indefinite; \$8,000; Ivan I. Wescoatt, Leader; reports available.

Address inquiries to: W. D. Klein, as in No. 6 above.

U. S. Fish and Wildlife Service, Office of River Basin Studies

1. Creel and Economic Census

The purpose of these studies was to determine recreational use, fishing harvest, and monetary expenditures by fishermen and persons accompanying them. The information will be used in the Curecanti unit and Seedskaadee project reports by the Fish and Wildlife Service to express an evaluation of the fishery resources in the project areas.

Data were collected by several crews each assigned to a specific reach of stream or streams and in one case a reservoir was included. The survey was conducted during a 3-month period of the fishing season, and each crew followed a work schedule designed to make sampling uniform in respect to time and space coverage. Total counts of fishermen were made and harvest and economic data were gathered from personal interviews of fishermen contacted at random in the study areas. The interviewers recorded this information on standard forms provided by the Service.

Colorado Game and Fish Department and Wyoming Game and Fish Commission cooperating; Curecanti unit - vicinity of Gunnison, Colorado, and Seedskaadee project - between Green River and LaBarge, Wyoming; began June 1956, to close February 1957; \$16,300; Arthur B. Eustis, Leader.

Address inquiries to: Arthur B. Eustis, U. S. Fish and Wildlife Service, Building 40, Denver Federal Center, Denver 2, Colorado.

# CONNECTICUT

## State Board of Fisheries and Game

### 1. A Creel Census on Wononskopomuc Lake

The objective is to determine the species of trout best suited for stocking in Connecticut trout lakes, the age class best suited for stocking and the period or periods most effective for stocking.

Equal numbers of brook, brown, and rainbow trout, both yearlings and 2-year-olds are stocked in Wononskopomuc Lake. The creel census gives approximately 80 percent coverage of the lake. Brown trout have provided the highest returns to the rod for the past 3 years. Recovery has varied from 60 to 80 percent.

Northwestern Connecticut; began December 1953, to close November 1957; \$6,000; Cole W. Wilde, Leader.

Address inquiries to: Cole W. Wilde, Federal Aid Coordinator, State Board of Fisheries and Game, State Office Building, Hartford, Connecticut.

### 2. Yellow Pike-Perch Fishery in Lake Lillinonah

The objective is to establish yellow pike-perch in the new 1,900-acre impoundment on the Housatonic River in western Connecticut.

Approximately 20,000,000 pike-perch eggs were obtained from New York and Ohio. These eggs were hatched in the State fish hatchery in Burlington and 9,800,000 day-old fry were stocked in Lake Lillinonah. The extent of survival has not been determined, but six pike-perch taken during sampling operations in October averaged  $9\frac{1}{2}$  inches long.

Western Connecticut; began November 1955, to close November 1958; \$4,000; James P. Galligan, Leader.

Address inquiries to: James P. Galligan, Supervisor of Fisheries Management, State Board of Fisheries and Game, State Office Building, Hartford, Connecticut.

### 3. Investigation of the Candlewood Lake Rainbow Trout Population

The objective is to determine the recovery rate of stocked adult rainbow trout and the contribution of other sources of rainbow trout to the fishery.

Three thousand 2-year-old rainbows were tagged and stocked last year. In addition to the tagging of adults, all rainbows of hatchery origin have been fin-clipped. This includes yearlings from the federal hatcheries for lake stocking and state fingerlings stocked in two tributary streams. By identifying every stocked rainbow with a mark or tag over a period of four to five years we can determine to what extent the naturally spawned wild trout contribute to the fishery. Also to be determined is the numbers of fingerlings and yearlings appearing in the catch.

Western Connecticut; began June 1955, to close 1959-1960; \$5,000; James P. Galligan, Leader.

Address inquiries to: James P. Galligan, as in No. 2 above.

### 4. Control of Submerged Vegetation

The objective is to control submerged vegetation in ponds where the density of these "water weeds" makes fishing or boating difficult or impossible.

Submerged vegetation is treated with 5 parts per million of sodium arsenite. This is sufficient to kill most submerged weeds with the exception of Myriophyllum, sp., which is treated with 7 parts per million.

Statewide; began May 1956, closed July 1956; \$3,788; Cole W. Wilde and James P. Galligan, Leaders.

Address inquiries to: Cole W. Wilde, as in No. 1 above.

## CONNECTICUT (Cont. )

### 5. Sea Run Brown Trout Study

The objective is to determine the distribution and abundance of sea-run brown trout in coastal streams and to develop this fishery by increasing the numbers of fish and create salter runs in at least two test streams.

Coastal streams and Connecticut River tributaries; began November 1955, to close November 1958; \$9,894; James P. Galligan, Leader.

Address inquiries to: James P. Galligan, as in No. 2 above.

### 6. Reclamation of Trout Ponds

The objective is to reclaim with rotenone those ponds suitable for trout management.

Four ponds were reclaimed in 1956. These were Greenfalls Reservoir, 47 acres; Mohawk Pond, 16 acres; Norwich Pond, 27 acres; and Uncas Lake, 70 acres. These ponds were treated with one part per million of emulsifiable rotenone and will be restocked with fingerling rainbows and browns as soon as they are no longer toxic.

Statewide; began August 1956, closed October 1956; \$5,000; James P. Galligan and Cole W. Wilde, Leaders.

Address inquiries to: James P. Galligan, as in No. 2 above.

### 7. Operation Alewife

The objective is to attempt to establish land-locked alewives in several lakes in the State.

The land-locked form of the alewife is already established in more than a dozen lakes. These small, 2- to 5-inch alewives furnish excellent forage for trout, bass, and pickerel. An attempt is being made to establish this species in five lakes by transferring adult sea-run fish during April and May. Spawning has in all cases been excellent and the young-of-the-year alewives are still in the ponds. Whether these fish will remain in the ponds until they reach spawning age is as yet not known.

Statewide; began April 1956, indefinite; \$1,500; James P. Galligan and Cole W. Wilde, Leaders.

Address inquiries to: James P. Galligan, as in No. 2 above.

## DELAWARE

### Board of Game and Fish Commissioners

#### 1. Pond Construction

The objective is to increase the available public fishing area in Delaware by the construction of ponds. These ponds are constructed on previous mill-pond sites. Adequate public parking and access areas are obtained in conjunction with the construction. The new ponds are stocked with a combination of bass and bluegills as they are completed.

Statewide; began July 1956, to close June 1957; \$90,000; Norman G. Wilder, Leader; reports available.

Address inquiries to: Jay L. Harmic, Board of Game and Fish Commissioners, Dover, Delaware.

#### 2. Acquisition

As privately owned fishing areas become available at suitable costs, they are acquired for public usage. These acquisitions include land for parking and access to public fishing waters, ponds and areas for launching along the Delaware River and Bay, and on freshwater ponds.

DELAWARE (Cont.)

Statewide; began July 1956, to close June 1957; \$35,000; Norman G. Wilder, Leader.

Address inquiries to: Jay L. Harmic, as in No. 1 above.

3. Freshwater Developments and Maintenance

The objectives are: (1) To increase the available fishing area on both marine and freshwaters by the installation of parking areas, launching ramps, and access roads, and (2) to insure continued public use of public fishing ponds in Delaware by the installation of launching ramps and public access areas.

Statewide; began July 1956, to close June 1957; \$35,000; Henry P. Cofer, Leader; reports available.

Address inquiries to: Jay L. Harmic, as in No. 1 above.

4. Marine and Freshwater Investigations

This is an omnibus project which provides for the scientific study of marine and freshwater fisheries problems and for the investigation of possibilities for the development of the sport fisheries.

Statewide; began July 1956, to close June 1957; \$25,000; Franklin Daiber and Jay L. Harmic, Leaders; reports available.

Address inquires to: For marine investigations - Franklin C. Daiber, University of Delaware, Newark, Delaware. For freshwater investigations - Jay L. Harmic, as in No. 1 above.

U. S. Fish and Wildlife Service, Branch of Fishery Biology

1. Survey of the Ocean Fisheries off Delaware Bay

A survey of the sport and commercial ocean fisheries in the coastal waters of southern New Jersey, Delaware, and the eastern shore of Maryland. Results include description of fishing grounds; methods of fishing; species composition of catch; measurement of total catch, effort, and catch per unit effort; and value of the fisheries in terms of investment and monetary return.

Delaware Department of Fish and Game, Marine Laboratory, University of Delaware and New Jersey Division of Fish and Game cooperating; Newark, Delaware; began January 1952, to close October 1957; \$7,000; F. C. June, Leader; reports available.

Address inquiries to: F. C. June, U. S. Fishery Laboratory, Beaufort, North Carolina.

FLORIDA

Game and Fresh Water Fish Commission

1. Lake and Stream Survey

The objective of this project is to catalog the lakes over 150 acres in size and the major streams of the State. This will be used to plan future fisheries work and furnish a guide for the fishermen of the State.

Statewide; began May 1954, to close June 1957; \$23,136; Edward Crittenden, Leader; reports available.

Address inquiries to: Edward Crittenden, Game and Fresh Water Fish Commission, Tallahassee, Florida.

2. Fish Management Investigations

The over-all objective of this program will be to test conventional and experimental fishing gear to determine whether effective control of undesirable

fish populations can be obtained and if this will result in improved sports fishing.

Statewide; began September 1953, to close June 1958; \$42,177; Melvin Huish, Leader.

Address inquiries to: Melvin Huish, P. O. Box 569, Leesburg, Florida.

### 3. River Basin Fisheries Investigation

The objectives are: (1) To re-evaluate field data collected by the Fish Management Division from 1947 to 1953. Also, to re-evaluate data from previous studies conducted by the U. S. Fish and Wildlife Service, Office of River Basins. All of this re-evaluated data will be compiled in terms of present hydrological conditions. (2) To determine the effects of ditching and diking, particularly in the highly productive littoral zones. (3) To determine the effects of fluctuating water levels and its effect upon the fishery resource as a whole. (4) To gather supplementary economic data. (5) To compile, analyze, and mesh data from this study with concurrent studies being carried out by the Fish and Wildlife Service and the Game Management Division of the Commission. All this data will be incorporated in reports to the flood control agencies. (6) To expand the survey to include other areas under consideration by the flood control agencies upon which they will request recommendations. Also, to expand the survey to include follow-up studies after the initial report is completed, and to make recommendations on future management, development, and access sites for the public.

Central and South Florida Flood Control District; began February 1956, to close November 1958; \$37,297; Jim Counselman, Leader; reports available.

Address inquiries to: Jim Counselman, Game and Fresh Water Fish Commission, P. O. Box 1838, Vero Beach, Florida.

### 4. Electrical Fish Control

The project includes: (1) Study of characteristics of electrical fields in natural waters and factors affecting these fields. (2) Design and construction of testing devices for measuring and determining the behavior of electricity in natural waters. (3) Design and construction of high frequency, pulsating, and sonic accessory components to be installed on present models of electrical fishing devices. (4) Modification of present models of electrical fishing units to increase efficiency. (5) Construction of an electrical fish control unit to be a practical fish management and rough fish control tool. (6) Laboratory and field experiments with behavior of fishes subjected to electrical treatment.

Statewide; began July 1956, to close June 1959; \$44,223; Timothy O'Connell, Leader.

Address inquiries to: Timothy O'Connell, P. O. Box 114, Okeechobee, Florida.

## University of Miami, Marine Laboratory

### 1. Statistics of Marine Fish Landings

The objective is to make available amounts and value of Florida marine fish landings. Landings are reported by months, by species, and by counties in a regular manner so short- and long-term fluctuations can be easily seen. Many species in these landings are sport as well as commercial fishes.

U. S. Fish and Wildlife Service and Florida State Board of Conservation cooperating; statewide; began 1950, continuing; \$4,000; C. P. Idyll and Billy F. Greer, Leaders; reports available.

Address inquiries to: Director, Marine Laboratory, University of Miami, 439 Anastasia Avenue, Coral Gables, Florida.

2. Fisheries Education (Ft. Myers Fishing School)

The objective is to interest high school students in the commercial fishing occupation, biological and technological fisheries research, and ultimately to expand the interest in fishery products and sport fishing through publicity. These aims are implemented by regular instruction by Marine Laboratory staff and by providing field trips to centers of commercial fishing and research activities.

State Board of Conservation cooperating; Ft. Myers, Florida; began March 1956, indefinite; \$1,000; C. P. Idyll, Leader; reports available.

Address inquiries to: As in No. 1 above.

3. Saltwater Game Fishing

In order to provide an accurate estimate of the value of saltwater game fishing to Florida this project was begun. The project consists of interviewing anglers, charter and party boat captains, and fishing camp operators in an effort to determine the expenses, both direct and indirect, connected with this sport. The interviews are carried out by conservation agents and the analysis by the scientific staff of the Marine Laboratory. In addition, a survey of fishing by use of spears on the Florida Keys has been initiated by Laboratory staff members.

State Board of Conservation cooperating; statewide; began January 1955, to close March 1957; \$21,700; C. P. Idyll, Leader; reports available.

Address inquiries to: As in No. 1 above.

4. Life Histories of Marine Fish

The biological aspects of several marine species of fish (snook, *Centropomus undecimalis*; weakfish, *Cynoscion nebulosus*; tarpon, *Tarpon atlanticus*; sailfish, *Istiophorus nigricans*) are under study to provide a sound basis for maintaining and increasing the catches of these fish. These studies involve age and growth, food habits, migrations, spawning habits, abundance, and catch-per-unit of effort.

State Board of Conservation cooperating; Southern Florida; \$16,000; C. P. Idyll, Leader; reports available.

Address inquiries to: As in No. 1 above.

U. S. Army Corps of Engineers, Jacksonville District, South Atlantic Division

1. The Biological Effects of Freshwater Discharge Into St. Lucie Estuary, Florida

St. Lucie Canal is the major outlet for floodwaters from Lake Okeechobee. This study is designed to determine biological conditions in the estuary before, during, and after discharge periods. Trawl, net, and seine samples will be taken at selected stations under various discharge conditions, and these data will be correlated with the station salinities, temperatures, and turbidities. With the present drought conditions no discharges are expected to be made through St. Lucie Canal this coming year. Therefore, the opportunity is available during this first year of study to ascertain the biological conditions and the various seasonal changes therein that normally occur in the estuary for later comparison with mid- and post-discharge conditions.

Began September 1955, continuing; \$3,200; District Engineer, Leader.

Address inquiries to: District Engineer, Corps of Engineers, Jacksonville District, Jacksonville, Florida.

2. The Application of Heated Fishing Docks to South Atlantic Division Reservoirs

This project involved a compilation of available information on heated fishing docks, as constructed and used on Oklahoma reservoirs, for use by Corps of Engineer personnel, biologists, concessioners, and fishermen

concerned with southern impoundments. The purpose of the report was to acquaint these groups with (1) the possibilities, which have been successfully demonstrated elsewhere, of increasing both the fisherman catch and the total number of annual fishing days, and (2) the means of providing comfortable as well as successful winter fishing.

Hdqtrs. Jacksonville, Florida; began June 1956, closed September 1956; \$100; Division Engineer, Leader; reports available.

Address inquiries to: Division Engineer, South Atlantic Division, Corps of Engineers, Atlanta, Georgia.

3. Study of the Spawning Migrations of Mullet Through St. Lucie Lock and Dam, Florida

This study will furnish supplementary data for a second year on the annual spawning run of mullet from Lake Okeechobee through St. Lucie Canal to the ocean. Following a fish kill during the peak of the 1955-56 run, emergency 24-hour operation of the lock as a fish ladder was necessary from December 13 to January 3 to assist spawners downstream. Certain precautionary measures have been adopted to insure safe passage for this fish during future runs, but more information is needed. Beginning November 1, 1956, daily observations of fish movement, concentrations of fish, weather conditions, and the number of lockages necessary for fish passage will be recorded throughout the downstream and return runs.

St. Lucie Lock and Dam near Stuart, Florida; began December 1955, continuing; \$500; District Engineer, Leader; reports available.

Address inquiries to: As in No. 1 above.

## GEORGIA

### Game and Fish Commission

1. Trout Stream Management Investigation

General objectives of this project include: (1) to survey the streams of North Georgia and determine which are suitable for trout, (2) to determine the utilization of these streams by the anglers, and (3) to evaluate the data obtained and prepare management recommendations for those streams that maintain trout populations.

In addition to general physical, chemical, and biological surveys, an intensive creel census is conducted on the streams of the Wildlife Management Areas. All trout placed in the streams are marked before being stocked to facilitate identification by the creel census clerks.

North Georgia; began March 1953, to close June 1959; \$25,800; Terrence J. Merkel, Leader; reports available.

Address inquiries to: Charles E. Lane, Jr., Federal Aid Coordinator, State Game and Fish Commission, 412 State Capitol, Atlanta, Georgia.

2. Reservoir Management Investigations

The general objectives are: (1) to determine the composition of the fish populations, (2) to determine the size and species of fish caught and angling success, (3) to determine the portion of the fish population removed by fishing and, (4) to evaluate the use of various types of commercial fishing gear on game and rough fish. This work is being done on four large impoundments in the northeastern part of the State.

A creel census and tagging study is underway on each reservoir as well as selected limnological studies.

Clark Hill, Allatoona, Jackson, and Sinclair Reservoirs; began October 1954, to close June 1957; \$36,929; W. W. Thomaston, Leader; reports available.

Address inquiries to: Charles E. Lane, Jr., as in No. 1 above.

3. Evaluation of Pond Management Practices

The general objectives are to determine the causes of pond failures and to evaluate the effectiveness of the following management techniques in the Piedmont and Coastal Plains Regions of Georgia; (1) removal of a portion of the fish population, (2) removal of the entire population and restock with desired species, (3) fertilization, (4) weed and algae control, (5) construction of in-flow diversion ditches, (6) corrective stocking, and (7) the use and amounts of agricultural lime.

Considerable work has been done on water quality and its relation to fish production. This project is divided into two independent sections, each working in one of the two major soil types within the State.

The Piedmont Plateau and Coastal Plain; began October 1954, to close June 1957; \$42,060; Howard D. Zeller, Leader, Piedmont Plateau, and Alex B. Montgomery, Leader, Coastal Plains; reports available.

Address inquiries to: Charles E. Lane, Jr., as in No. 1 above.

4. Fisheries Survey

The general objectives of the project are: (1) to provide information on the physical, chemical, and biological features of the State's public water areas; (2) to provide information on species composition of the fish populations, distribution of the principal game fish, and data on age and growth of these fish; (3) to determine the extent and effects of pollution on aquatic life and game fish populations; and (4) to provide recommendations for management and future investigational and developmental work.

Statewide; began July 1956, to close June 1959; \$70,903; James H. Padfield, Leader.

Address inquiries to: Charles E. Lane, Jr., as in No. 1 above.

U. S. Fish and Wildlife Service, Branch of Game-fish and Hatcheries

1. Fishery Management Surveys

The objective of this study is to develop fish management plans based on surveys for specific water areas. Priority is given to Federally controlled areas such as Fish and Wildlife Service Refuges, National Forests, Veterans Administration facilities, defense installations, and Indian reservations.

Headquarters - Atlanta, field work in the 12 southeastern States comprising Fish and Wildlife Service Region 4; began 1951, continuing; Marvin A. Smith, Robert T. Webb, and Braden Pillow, Leaders.

Address inquiries to: U. S. Fish and Wildlife Service, Branch of Game-fish and Hatcheries, Atlanta 23, Georgia.

2. Technical Assistance in Fish Cultural Activities

Assistance is given to fish cultural personnel in the solution of biological problems of hatchery management, such as weed control, fertilization, disease, water quality, and initiating new or improved techniques. Fish stocking activities are reviewed for correlation with State Conservation Department practices and to direct the distribution of Federally produced fish in accordance with Fish and Wildlife Service policy and known fishery management needs.

Headquarters - Atlanta, field work in 12 southeastern States comprising Fish and Wildlife Service Region 4; began 1950, continuing; Jack Snow,

## GEORGIA (Cont.)

Marvin A. Smith, James R. Fielding, Robert Webb, and Braden Pillow, Leaders.

Address inquiries to: As in No. 1 above.

### 3. Farm Pond Demonstration Program

A series of ponds are seined and analyzed for population balance. Ponds in different stages of balance are selected and a demonstration is arranged for interested Soil Conservation Service personnel and farm pond owners. In addition to this visual demonstration of balanced and unbalanced fish populations, proper management techniques are demonstrated. An effort is also made to show interested persons the effects of improper management.

Soil Conservation Service cooperating; Headquarters - Atlanta, field work in the 12 southeastern States comprising Region 4 of the U. S. Fish and Wildlife Service; began August 1955, continuing; Robert T. Webb, Leader.

Address inquiries to: Regional Director, U. S. Fish and Wildlife Service, Peachtree - Seventh Building, Atlanta 23, Georgia.

## U. S. Fish and Wildlife Service, Branch of Fishery Biology

### 1. Biochemistry of the Waters off the South Atlantic Coast of the United States

The objective of this project is to determine the distribution and concentration of nutrients and the relation between these nutrients and the distribution and concentration of fishes as a means of delimiting potentially productive waters.

Game and Fish Commission cooperating; Headquarters - Brunswick; began February 1953, continuing; William W. Anderson, Leader; reports available.

Address inquiries to: William W. Anderson, Chief, South Atlantic Fishery Investigations, P. O. Box 283, Brunswick, Georgia.

### 2. Biological Inventory of Waters off the South Atlantic Coast of the United States

The objective is to determine the presence, identity, distribution, and inter-relationships of marine forms in the area as an aid in understanding the presence, abundance, availability, and fluctuations of the fishes. Special attention is directed to the distribution and abundance of fish eggs, larvae, and juveniles.

Georgia Game and Fish Commission and Florida State Board of Conservation cooperating; headquarters - Brunswick; began February 1953, continuing; William W. Anderson, Leader; reports available.

Address inquiries to: William W. Anderson, as in No. 1 above.

## IDAHO

### Department of Fish and Game

### 1. Biological and Economic Survey of Fishery Resources in Lake Pend Oreille

This project, in its sixth year, is designed to measure the effects of Albeni Falls Dam, located on the outlet of Lake Pend Oreille, and Cabinet Gorge Dam, located on the inlet or principal tributary, on the very important sport and commercial kokanee fishery and upon the sport trout fishery. Creel census and biological surveys, including age-growth, length frequency, and spawning escapements of the kokanee, and limnological studies of the lake, are used to evaluate the fishery and the effects of the dams. Statistical analyses of all creel census data are made.

Washington Water Power and Corps of Engineers cooperating; Bonner and Kootenai Counties; began June 1951, to close April 1959; \$15,000; Charles Whitt, Leader; reports available.

Address inquiries to: James C. Simpson, Chief of Fisheries, Idaho Department of Fish and Game, 518 Front Street, Boise, Idaho.

2. Cocolalla Lake Fisheries Restoration

This project is aimed at the restoration of a 770-acre trout lake and will include land acquisition for public access, construction of a migration-block dam in the outlet from the lake, eradication of all fish in the lake, restocking with trout, and development of the area for public use.

Bonner County; began June 1956, to close July 1958; \$50,000; Paul Jeppson, Leader.

Address inquiries to: James C. Simpson, as in No. 1 above.

3. Mountain Lakes

The objectives of this project are to make available for better public use a number of mountain lakes not presently available for recreational use because of the difficulty of access or because of improper or lack of directional or designational signs. About 30 miles of trail, both all-purpose and foot, will be constructed into a wilderness area in the Sawtooth Mountains to provide access for recreational use of the area, including angling use to about 30 lakes. A number of signs will be constructed to help the public find trails to lakes, in both this as well as other areas not marked at the present.

U. S. Department of Agriculture, U. S. Forest Service cooperating; Central Idaho; began June 1956, to close December 1957; \$20,000; Forrest R. Hauck, Leader.

Address inquiries to: James C. Simpson, as in No. 1 above.

4. Fisheries Investigations on Bear Lake

This study is designed to determine management policies for the sport fishery involving rainbow, cutthroat, and mackinaw trout and several species of whitefish.

Utah State Agricultural College cooperating; Southern Idaho and northern Utah; began January 1953, closed December 1956; \$5,000; William J. Clark, Leader; reports available.

Address inquiries to: James C. Simpson, as in No. 1 above.

5. Fisheries Investigations of Henry's Lake

The objectives are to determine the causes and extent of natural mortality of the cutthroat trout of an important lake fishery thereby providing management data.

Fremont County; began March 1954, closed December 1956; \$6,000; Donald Andriano, Leader; reports available.

Address inquiries to: James C. Simpson, as in No. 1 above.

6. Clearwater River Fisheries Investigation

This is a study of the steelhead rainbow trout in a major river system in Idaho, designed to determine its contribution to the sport fishery both as adults returning from the sea and as fingerling trout prior to migration to the sea. Life history, identification, stream populations and migration studies are involved. Catch and economics of the fishery are also being measured.

Central Idaho; began June 1954, to close June 1957; \$30,000; Leon Murphy, Leader.

Address inquiries to: James C. Simpson, as in No. 1 above.

7. Statewide Fishing Harvest Survey

Under this project all licensed Idaho anglers are sampled for fishing intensity and harvest data through the use of a questionnaire. Intended use of the findings is for management of sport fisheries on a statewide or large-area basis.

Statewide; began September 1954, indefinite; \$3,000; Forrest R. Hauck, Leader; reports available.

Address inquiries to: James C. Simpson, as in No. 1 above.

8. Experimental Rough Fish Control

This study is designed to determine economical methods of harvesting non-game fish species and ways in which they might be used. The effect of partial removal of rough-fish populations on game fish is also being measured.

Various types of traps and nets are being evaluated as to their ability to catch fish so that they may be used in waters where the more conventional method of taking fish in seines cannot be used. Life history data of the species of non-game fishes under study are also being collected.

Lake Lowell, Lake Wilson, and American Falls Reservoir; began December 1954, to close December 1957; \$25,000; Monte Richards, Leader.

Address inquiries to: James C. Simpson, as in No. 1 above.

9. Silver Creek Stream Improvement

The objective of this project is to evaluate several types of improvement structures in Silver Creek. Every few years this stream is swept clean of the aquatic vegetation, Chara principally, which provides cover for the rainbow trout populations. The improvement structures are of K-dam, sheet-piling, and concrete block (tongue and groove) construction, and are so placed that pools will be formed to replace the loss of cover.

Blaine County; began September 1954, to close November 1958; \$5,000; Robert Irving, Leader.

Address inquiries to: James C. Simpson, as in No. 1 above.

10. North Idaho and Boundary County Lake Development

In these projects nine trout lakes were restored to recreational angling by treatment of the waters and restocking with trout. In addition, a public dock and boat launching area were developed on Pend Oreille Lake, making possible the safe launching of boats adjacent to a public camp ground.

Gonner and Boundary Counties; began August 1954, closed September 1956; \$16,000; Paul Jeppson, Leader.

Address inquiries to: James C. Simpson, as in No. 1 above.

11. Rehabilitation of Stanley Lake

The restoration of this 200-acre lake to recreational trout angling involved the construction of a fish migration block in the outlet, eradication of the fish in the lake, and restocking with rainbow trout. The migration block is a low, concrete dam on the outlet. Fertilization experiments are planned on the lake. Productivity measurements will be made when a nitrogen deficiency is overcome and the four basic elements are brought into balance.

Custer County; began July 1954, to close September 1957; \$3300; Robert Irving, Leader.

Address inquiries to: James C. Simpson, as in No. 1 above.

12. Waha and Blue Lakes Rehabilitation

Two lakes in north-central Idaho were restored by eradication of rough fish species and restocking with trout. Access roads and a parking and boat-launching area were developed.

IDAHO (Cont. )

Nez Perce County; began August 1955, closed December 1956; \$7400; Leon Murphy, Leader.

Address inquiries to: James C. Simpson, as in No. 1 above.

University of Idaho

1. A Study of the Influence of Logging on Trout Streams in Northern Idaho

The purpose of this project is to measure the effects of logging and associated activities on certain physical, chemical, and biological features of streams within the drainage areas. Two pairs of streams have been under investigation for two years. One of each pair will be logged in the next few years, the other will be left uncut for another five or six years, to serve as a control. Measurements on all streams will continue on a maintenance basis and will include temperature, flow, turbidity, sedimentation, oxygen, alkalinity, pH, conductivity, production of bottom organisms, age, growth, abundance, and food habits of the fish populations.

Potpatch Forests, Inc. and U. S. Forest Service cooperating; St. Joe and North Fork Rivers; began June 1955, to close 1965; \$2,000; Virgil S. Pratt, Leader.

Address inquiries to: Virgil S. Pratt, Idaho Cooperative Wildlife Research Unit, University of Idaho, Moscow, Idaho.

2. A Fishery Survey of Priest Lake, Idaho

The objectives are to measure the production and sport catch of cutthroat, Dolly Varden, and lake trouts, and kokanee in Priest Lake and to determine the cause or causes of the decline of the cutthroat population. The project embraces general studies of certain limnological features of the lake and detailed studies of the fish populations. Included are investigations of game fish production and catch, food habits, spawning activities, age and growth, and contribution of the tributaries to the game fish population of the lake.

Idaho Fish and Game Department cooperating; Bonner County; began June 1955, to close February 1957; \$5,000; Ted C. Bjornn, Leader.

Address inquiries to: Virgil S. Pratt, as in No. 1 above.

U. S. Fish and Wildlife Service, Branch of Fishery Biology

1. Effect of Light Waves on the Migration of Salmon Fingerlings

This project has three objectives: (1) To study the effect of light on guiding downstream migrants, (2) To determine the most effective type of light source for guiding fish, through experiments with different light arrays, and (3) To determine whether practical installations can be made at water-use projects.

Redfish Lake, Salmon River, Idaho; began 1954, to close 1957; \$8802; D. R. Craddock, Leader.

Address inquiries to: Clinton E. Atkinson, Chief, Pacific Salmon Investigations, 2725 Montlake Blvd., Seattle 2, Washington.

U. S. Fish and Wildlife Service, Office of River Basin Studies

1. Investigations on Biological Limitations

The purpose of this project is to determine the factors controlling the production of fish in a stream. The factors studied are the physical characteristics of the stream and the water, the quantity of and quality of spawning areas, and the kind and amount of food available to the fish.

Salmon River; began September 1955, indefinite; \$12,000; Arthur S. Hale, Leader.

Address inquiries to: Regional Director, U. S. Fish and Wildlife Service, P. O. Box 3737, Portland 8, Oregon.

## ILLINOIS

### Department of Conservation

#### 1. Mississippi River Survey

Fisheries biologists are collecting creel data and locating possible access sites along the 573-mile stretch of the Mississippi River bordering Illinois to determine its present use and further development of the sport fishery.

Illinois Natural History Survey cooperating; Mississippi River and backwaters bordering Illinois; began April 1956, to close March 1958; \$28,000; Robert F. Klant, Leader.

Address inquiries to: William C. Starrett, Illinois Natural History Survey Laboratory, Havana, Illinois.

#### 2. Collection of Commercial Fisheries Statistics

Fisheries biologists are collecting data by personal contact with commercial fishermen in order to obtain accurate commercial fisheries statistics which have definite values for administration in development and management phases of the over-all fisheries resources in the State.

Illinois Natural History Survey cooperating; statewide; began January 1953, continuing; \$7,000; Sam A. Parr, Leader; reports available.

Address inquiries to: Sam A. Parr, Superintendent, Division of Fisheries, 102 State Office Building, Springfield, Illinois.

#### 3. Creation of New Fishing Waters

Creation of artificial lakes with the primary usage designated as sport fishing is continuing using state and Federal Aid funds. Several lakes have been completed and more are planned.

Statewide; began July 1946, continuing; \$500,000; Sam A. Parr, Leader.

Address inquiries to: Sam A. Parr, as in No. 2 above.

#### 4. Fish Management on Illinois Waters

Fisheries investigations, management services, and development procedures are being performed on water areas throughout the State.

Statewide; began July 1950, continuing; \$125,000; Sam. A. Parr, Leader; reports available.

Address inquiries to: Sam A. Parr, as in No. 2 above.

### Illinois Natural History Survey

#### 1. Tests of Commercial Fertilizers for Improving Fish Ponds

The improvement in pond fishing resulting from the addition of commercial fertilizers is being studied.

Southern Illinois; began 1947, indefinite; Donald F. Hansen, Leader.

Address inquiries to: Donald F. Hansen, 276 Natural Resources Building, Urbana, Illinois.

#### 2. Responses of Several Common Fishes to an Annual Artificial Lake Level Manipulation

Several artificial lakes are subjected to annual drawdowns in order to determine the effect of such drawdowns upon several common species of warm-water fishes including largemouth bass, smallmouth bass, bluegills, green sunfish, redear sunfish, warmouth bass, and black bullheads.

Statewide; began 1950, indefinite; George W. Bennett, Leader; reports available.

Address inquiries to: George W. Bennett, 271 Natural Resources Building, Urbana, Illinois.

3. Ecology of Stream Fishes

The objective is to investigate the factors which control the relative abundance of various kinds of fishes in small swift streams of upland Illinois, with special emphasis on the smallmouth bass and other fishes of interest and importance to sport fishermen.

Jordan Creek is in east-central Illinois and is a base point for studies because its flow may be spanned by weirs for controlling the movement of indigenous fishes. Other streams, mainly in central Illinois, are being studied.

Illinois Department of Conservation cooperating; central Illinois; began 1949, indefinite; R. Weldon Larimore, Leader; reports available.

Address inquiries to: R. Weldon Larimore, 277 Natural Resources Building, Urbana, Illinois.

4. Commercial Fishing and Sport Fishing Yields from a Bottomland Lake Adjacent to the Illinois River

For six years, Chautauqua Lake near Havana, Illinois, has been cropped with commercial fishing tackle of various kinds. At the same time, the lake has been open to controlled hook-and-line fishing.

Illinois Department of Conservation and the U. S. Fish and Wildlife Service cooperating; Havana; began 1950, indefinite; William C. Starrett, Leader; reports available.

Address inquiries to: William C. Starrett, Illinois Natural History Survey, Havana, Illinois.

5. Smallmouth Bass in Warm-Water Ponds

To discover the factors that control populations of smallmouth bass in typical warm-water ponds in Illinois, a number of ponds have been stocked with smallmouth bass alone or in combination with other kinds of fishes. Warm water in itself does not seem to be a limiting factor as far as the smallmouth bass is concerned.

Central Illinois; began 1946, indefinite; George W. Bennett, Leader.

Address inquiries to: George W. Bennett, as in No. 2 above.

Quincy College

1. Bottom Fauna of the Middle Mississippi River in Relation to Navigation Structures and Practices

The objective is to study the effects of water-level variation in a navigation pool on bottom organisms. Year-round collections were made in the river and in a connected secondary channel over a 2-year period; one year in which the water level was maintained at all times, and one year in which the water level was drawn down 4 feet during the winter.

National Science Foundation Grants cooperating; Cottonwood Chute and Mississippi River Pool No. 21, opposite Quincy; began November 1954, closed November 1956; \$3500; Troy C. Dorris, Leader.

Address inquiries to: Troy C. Dorris, Department of Zoology, Oklahoma A. and M., Stillwater, Oklahoma.

Southern Illinois University

1. Comparison of the Growth of Redear Sunfish and Bluegill From Lake Murphysboro

A study of the growth of these species that were stocked in Lake Murphysboro at the same time to determine if it is desirable to continue stocking the redear sunfish in this region.

ILLINOIS (Cont. )

Lake Murphysboro; began June 1956, closed October 1956; \$500; Darrell Louder, Leader; reports available.

Address inquiries to: Cooperative Fisheries Management Research Laboratory, Southern Illinois University, Carbondale, Illinois.

2. Sedation of Fish Populations

This investigation concerns the use of chemicals to stun wild or native populations of fish as a fish management technique.

Illinois Department of Conservation cooperating; Southern Illinois University; began September 1955, closed December 1956; \$1,000; Bruce Muench, Leader; reports available.

Address inquiries to: As in No. 1 above.

3. A Study of Gizzard Shad Populations

A study of the growth, length-frequency distribution and other pertinent data on this important forage species.

Illinois Department of Conservation cooperating; southern Illinois; began May 1952, closed September 1956; \$350; reports available.

Address inquiries to: Same as in No. 1 above.

4. Fish Population of Big Creek

A Study of the fish population of a small stream in the Ohio River drainage.

Illinois Department of Conservation cooperating; Big Creek watershed; began June 1953, closed August 1956; \$700; reports available.

Address inquiries to: As in No. 1 above.

5. Life History of the Steel-colored Minnow, Notropis whipplii

A study of the life history of this shiner.

Illinois Department of Conservation cooperating; southern Illinois; began June 1956, to close October 1957; \$350; William M. Lewis, Leader.

Address inquiries to: As in No. 1 above.

6. Contributions to the Life History of the Stoneroller, Campostoma anomalum

A study of the life history of this important bait species.

Began November 1955, closed December 1956; \$900; James C. Schmulbach, Leader; reports available.

Address inquiries to: As in No. 1 above.

7. A Study of Horseshoe Lake to Determine Management Methods

A study of the lake and its present fish population in order to provide a basis for management recommendations.

Illinois Department of Conservation cooperating; Horseshoe Lake; began June 1956, closed October 1956; \$3,000; Bruce Muench, Leader; reports available.

Address inquiries to: As in No. 1 above.

8. Loss of Fish Over Spillways

Fish lost over the spillways of two local lakes are caught in traps and are counted and measured.

Illinois Department of Conservation cooperating; Little Grassy and Lake Murphysboro; began April 1954, closed July 1956; \$300; Darrell Louder, Leader; reports available.

Address inquiries to: As in No. 1 above.

ILLINOIS (Cont.)

9. Creel Census of Crab Orchard Lake, Horseshoe Lake, and Lake Murphysboro  
The project consists of a creel census of boat fishermen to assist fishermen in locating the lakes in which fish are biting, to determine changes in harvest from year to year, and to indicate management needs.  
Illinois Department of Conservation cooperating; southern Illinois; began May 1951, continuing; \$1400.  
Address inquiries to: As in No. 1 above.
10. Localized Fertilization on New Thompson's Lake  
This project involves fertilization of a small lake to increase growth of fish without producing nuisance conditions on the swimming beach.  
New Thompson's Lake Fishing Club and Illinois Department of Conservation cooperating; southern Illinois; began June 1956, to close October 1957; \$600; Vernon W. Cole, Leader.  
Address inquiries to: As in No. 1 above.
11. Treatment of Acid Ponds in the Pyatt Strip Mine Area  
Acid ponds are treated with hydrated lime or other chemicals to produce fish habitat and to find the method of managing such ponds for best results.  
Sport Fishing Institute, Southern Illinois Coal Strippers Association and Illinois Department of Conservation cooperating; southern Illinois; began June 1956; indefinite; \$750; Vernon W. Cole, Leader.  
Address inquiries to: As in No. 1 above.

Forest Preserve District of Cook County

1. Management and Development of Fishing Waters in the Cook County Forest Preserve  
The Forest Preserve District carries out fish surveys, aquatic weed control, and other fish management activities. It prepares engineering plans and makes improvements on existing waters as well as constructs new ones.  
Illinois Department of Conservation cooperating; Cook County; continuing; \$38,500; David H. Thompson, Leader; reports available.  
Address inquiries to: Roland F. Eisenbeis, Superintendent of Construction, Forest Preserve District of Cook County, 536 North Harlem Avenue, River Forest, Illinois.

INDIANA

Division of Fish and Game

1. A Chemical, Physical, and Biological Survey of the Muscatatuck River  
Data are being collected in the following phases of the project: composition and relative abundance of the fish population; migration of stream fishes; abundance and distribution of forage fishes; age and growth studies; physiography and land use; pollution and its effects; and fishing pressure on streams of this system. Fish populations at 100 sites within the watershed have been sampled by use of DC electro-fishing gear. Eight to ten more sites will complete this phase of the project.  
Indiana Board of Health cooperating; southeastern Indiana; to close June 1957; H. E. McReynolds, Leader.  
Address inquiries to: Indiana Fisheries Research Laboratory, Versailles, Indiana.

## INDIANA (Cont. )

### 2. A Continuing Creel Census of an Impoundment

A creel census was initiated in June 1955, to collect data on the 1500-acre lake on the Willow Slough State Game Preserve. Objectives include an accumulation and analysis of the fishing pressure, total angler yield, movement of fishes, and year-to-year fluctuations in the fish populations. This impoundment is open to year-round fishing with the exception of the waterfowl season.

Murphy Lake on the Willow Slough State Game Preserve, Newton County; began June 1955, to close September 1959; H. E. McReynolds, Leader.

Address inquiries to: H. E. McReynolds, Indiana Fisheries Research Laboratory, Versailles, Indiana.

### Indiana University

#### 1. Seasonal Mortality Rates in a Bluegill Population

The objective is to determine mortality rates in bluegill populations at different seasons of the year. The experiments are being carried out in controlled ponds. They involve a multiple marking technique by which mortality rates can be estimated over short periods of time.

Began 1955, to close 1957; Joseph Hanegan, Leader.

Address inquiries to: Joseph Hanegan, Department of Zoology, Indiana University, Bloomington, Indiana.

#### 2. Effect of Temperature on the Digestion of Food by Bluegills

Bluegills are fed a weighed amount of food, exposed to temperatures ranging from 5° to 20° C., and sacrificed at intervals to determine the amount of food digested.

Began 1956, to close 1957; Russell Malcolm, Leader.

Address inquiries to: Shelby D. Gerking, Department of Zoology, Indiana University, Bloomington, Indiana.

#### 3. The Efficiency of Food Utilization by a Fish Population

Bottom fauna and fish populations are being studied simultaneously. Estimates of food consumption by the fish will be compared directly with the amount of food available. The experiment is being conducted on a small 8-acre lake in northern Indiana.

National Science Foundation cooperating; Wyland Lake; began May 1955, to close May 1957; \$10,000; Shelby D. Gerking, Leader.

Address inquiries to: Shelby D. Gerking, as in No. 2 above.

#### 4. The Sensory Basis of Homing in the Longear Sunfish

The importance of the olfactory and visual senses upon homing is being studied by displacing fish from their home range. The fish are either blinded or have the olfactory epithelium destroyed before displacement.

Richland Creek, began June 1956, to close 1958; Gerald E. Gunning, Leader.

Address inquiries to: Gerald E. Gunning, Department of Zoology, Indiana University, Bloomington, Indiana.

### St. Mary's College

#### 1. Food Habits and Distribution of the Larvae of the Marine Lamprey, Petromyzon marinus, in Rivers Flowing into Lake Michigan

The objectives are to establish the food habits and distribution of the marine lamprey during larval stages.

St. Mary's College and the University of Notre Dame; began June 1955,

## INDIANA (Cont. )

to close June 1957; \$300; Clarence F. Dineen and Alan Rick, Leaders; reports available.

Address inquiries to: Clarence F. Dineen, St. Mary's College, Notre Dame, Indiana.

### University of Notre Dame

1. A Phylogenetic Study of the Centrarchid Fishes Based on Their Ecology and a Statistical Analysis of Osteological Variations

The objectives are to relate contemporary forms with fossils, and to determine the phylogenetic relationships based on osteology and ecology, and to compare the results with established relationships based largely on external characteristics.

American Academy of Arts and Sciences cooperating; St. Mary's College and the University of Notre Dame; began June 1955, to close 1958; \$600; Clarence F. Dineen and Paul S. Stokely, Leaders; reports available.

Address inquiries to: Paul S. Stokely, University of Notre Dame, Notre Dame, Indiana.

## IOWA

### State Conservation Commission

1. New Lake Construction

The objective is to provide all forms of water recreation especially in localities in the State that do not contain useable lakes or impoundments. The Fish and Game Division through its Fisheries Section stocks the lakes and supervises fish management.

Statewide; continuous; C. L. King, Leader.

Address inquiries to: K. M. Madden, Superintendent of Fisheries Section, East 7th and Court, Des Moines, Iowa.

2. Lake and Stream Public Access

The objective of the project is to provide free public access to lakes and streams for angling and other recreational purposes. Acquisition of tracts of land adjacent to good fishing waters is undertaken whenever such tracts become available.

Statewide; continuing; L. P. Bailey, Leader; reports available.

Address inquiries to: Lester F. Faber, East 7th and Court, Des Moines, Iowa.

3. Statewide Undesirable Fish Control

Reduction or elimination of undesirable fish population to improve sports angling is the goal. Permanent fish traps, small mesh seines, electro-fishing gear, drainage, partial and complete chemical suffocants are used.

Statewide; began 1909, continuing; \$60,000; C. O. Farrel, Leader; reports available.

Address inquiries to: K. M. Madden, as in No. 1 above.

4. Angling Instructions

The objective is to teach productive methods of catching panfish as an aid in improving game fishing through species control. Commission employees participate in Kid Fish Days, Fishing Clinics (for all ages), as well as radio and television programs, and press releases are prepared.

Statewide; continuing; \$6,000; C. L. King, J. R. Stoker and F. G. Harker, Leaders.

Address inquiries to: K. M. Madden, as in No. 1 above.

5. Lake Manawa Restoration

Water was originally supplied to Lake Manawa by the direct inflow of Mosquito Creek and flood flows of the Missouri River. Mosquito Creek was channeled away from the lake and the construction of several flood control reservoirs on the Missouri River above Lake Manawa has greatly lowered its flood stage. To supply water to the lake a permanent diversion structure was placed in Mosquito Creek and 8,000 feet of 48-inch underground pipe was laid from the structure to the lake.

Pottowattamie County; began December 1955, closed November 1956; \$303,000; Darrell M. Hill, Leader; reports available.

Address inquiries to: Glen G. Powers, East 7th and Court, Des Moines, Iowa.

6. Creation of New Water Areas

On new areas created for waterfowl, measures are taken to provide habitat for game fish. These areas are then stocked. The fishery becomes an important by-product of the waterfowl areas.

Statewide; began 1953, continuing; L. P. Bailey and C. L. King, Leaders; reports available.

Address inquiries to: Lester F. Faber, as in No. 2 above.

7. Aquatic Weed Control

Surveys are conducted to determine the nature and extent of weed growths in lakes as well as the cost involved and need for control. Weed control operations are carried out under State direction. Chemical control has been found to be most economical and effective.

Statewide; began June 1955, continuing; \$10,000; E. T. Rose, F. G. Harker and C. L. King, Leaders; reports available.

Address inquiries to: E. B. Speaker, East 7th and Court, Des Moines, Iowa.

8. Natural Nursery Lakes

The objective is production of advanced walleye and northern pike fingerlings for statewide predator fish stocking to directly aid public fishing and species control efforts. Growth curve analysis is used to dictate frequency of fingerling removal.

Statewide; continuing; \$16,000; F. G. Harker and Tom Moen, Leaders.

Address inquiries to: K. M. Madden, as in No. 1 above.

9. Creel Census of Natural Lakes and Mississippi River

The objective is to determine the success of anglers on the Mississippi River and several major Iowa lakes. Nine creel census clerks gather catch statistics including partial and total creels. Aerial counts of bank and boat fishermen are taken co-operatively by Iowa, Illinois, and Wisconsin on the Mississippi River in addition to the ground contacts.

Statewide; revised April 1955, continuing; \$20,000; E. T. Rose, Tom Moen and R. E. Cleary, Leaders; reports available.

Address inquiries to: E. B. Speaker, as in No. 7 above.

10. Exploratory Fishing on Mississippi River

The objectives are to determine population trends of the principal game

and non-game fishes, the extent of exploitation, length-weight relationships, and species composition of the catch. This was a joint effort of the member states in the Upper Mississippi River Conservation Committee.

Wisconsin and Illinois Conservation Departments cooperating; began June 1956; \$4000; R. E. Cleary, Leader; reports available.

Address inquiries to: E. B. Speaker, as in No. 7 above.

11. A Population Study of Walleyes

A long-term walleye fry stocking experiment now in its twelfth year is coupled with this study. In addition to the fry, a limited number of fingerlings have been stocked from nursery units. The progress of the walleye population has been followed by extensive gillnetting during the spawning run and through the summer surveys with 500 feet of 1/4-inch seine. A total walleye population estimation of this lake will be made again in 1956.

Began April 1944, continuing; \$500; E. T. Rose and Tom Moen, Leaders; reports available.

Address inquiries to: E. B. Speaker, as in No. 7 above.

12. Rough Fish Studies

This project involves a general collection of data on carp, buffalo, sheepshead, and gizzard shad. The primary portion of this study has concerned food habits, but data have also been collected on ecology, age and growth, reproduction, sexual maturity, number of eggs per fish and condition factors in an over-all effort to determine the interrelations existing between rough fish and their environment and between rough fish and game fish.

Began January 1946, continuing; \$1,000; Tom Moen, Leader; reports available.

Address inquiries to: E. B. Speaker, as in No. 7 above.

13. The Value of Stocking Walleyes in Iowa Streams

The object of this investigation is to study the possibility of supplementing our stream fisheries by the introduction of hatchery-reared walleyes. Stocking is on an alternate year basis. Collections of scales are made to determine whether or not the majority of fish caught come from the years in which walleyes are planted.

Iowa; began May 1950, continuing; \$500; R. E. Cleary and Harry M. Harrison, Leaders; reports available.

Address inquiries to: E. B. Speaker, as in No. 7 above.

14. Factors Affecting Smallmouth Bass Production in Northeastern Iowa

This project involves a multi-phase study of the life history and ecology of smallmouth bass in streams. Data are gathered annually on the number of nests seen per mile, condition and location of nests, effect of changed environment, effect of stream flow, turbidity, number of fingerlings per 500 feet of seining, age and growth, and bottom fauna. Effort is also being made to correlate good and poor natural hatches with age and survival data on minnows to attempt to discover forage indicator species which will give accurate insights into annual reproduction success of the smallmouth bass.

Began May 1949, continuing; \$2000; R. E. Cleary, Leader; reports available.

Address inquiries to: E. B. Speaker, as in No. 7 above.

15. A Study of Hatchery Techniques at Spirit Lake, Clear Lake, and Lansing.

The project was set up to study general hatchery procedures as they are concerned with the hatching and stocking of walleye and northern pike. Basic

data are collected on production (total number of eggs), number of eggs per quart at various stages of development, fertility, temperatures, and number and sex of fish handled. Some experimental work is being carried on in methods of handling both eggs and fish and in the use of sedatives and pituitary glands.

Began April 1946, continuing; \$750; Tom Moen, Garfield Harker, and Bob Stoker, Leaders.

Address inquiries to: E. B. Speaker, as in No. 7 above.

16. Natural Lakes Survey

All of the natural lakes managed for angling are surveyed each year. This involves test seining with 500 feet of 1/4-inch mesh (bar) seine at several stations on each lake. Pound and gill nets are used to supplement the seine catch. The small-mesh seine hauls are designed to determine primarily the magnitude of reproduction each year, and the nets to determine population fluctuations and status of the adult fishes. Fishes taken are sorted into young-of-the-year and older groups, weighed, measured, and scale samples taken from representatives for age and growth analyses. Data on vegetation, amount of bottom foods (dredge samples), turbidity, and lake chemistry are also obtained. Electro-fishing devices, both AC and DC, were used to supplement nets and seines in the population studies in 1956.

Statewide; began July 1940, continuing; \$7500; E. T. Rose, Leader; reports available.

Address inquiries to: E. B. Speaker, as in No. 7 above.

17. Artificial Lakes Survey

A continuing inventory is maintained in the form of an annual netting survey, electrical shocker sampling, and limited limnological investigations of the artificial lakes. Although special emphasis is placed on the relative abundance of each species and extent of reproduction, other items such as age and growth, abundance of bottom fauna, extent and species of vegetation, turbidity, and extent of chemical and thermal stratification are determined.

Southern Iowa; began September 1947, continuing; \$3000; James Mayhew, Leader; reports available.

Address inquiries to: E. B. Speaker, as in No. 7 above.

18. Continuing Inventory of the Fishes of Iowa Streams

The project involves population trend determinations by netting surveys at fixed stations. Each survey station is visited annually at the same time each successive year to approximate similar ecological conditions. Specimens are taken with trap and hoopnets and the data are handled on a catch and weight per net-hour basis. Reproduction indices are gathered at the station by use of a 25-foot drag seine. The geographical distribution of the various species in the State is recorded.

Statewide; began June 1949, continuing; \$8000; H. M. Harrison and R. E. Cleary, Leaders; reports available.

Address inquiries to: E. B. Speaker, as in No. 7 above.

19. Creel Census of Artificial Lakes

The objective is to determine the success of anglers on the artificial lakes in Iowa. In addition to the creel census on six lakes information was gathered from boat liveries on four additional lakes. This technique was designed to (1) census a segment of the angler harvest, (2) compare incomplete with completed fishing trip harvest, and (3) to design an economical means of sampling with the minimum of expense and effort.

Southern Iowa; May 1956, continuing; \$2000; James Mayhew and C. L. King, Leaders.

Address inquiries to: E. B. Speaker, as in No. 7 above.

20. Stream Creel Census

Two creel censuses are taken in Iowa streams to determine the catch per hour of effort, species composition, and seasonal success of anglers. One census employs the use of "expert" voluntary anglers who fish primarily in waters of northeast Iowa, and the second is a form of spot survey taken at random intervals with departmental help on the Des Moines River and its major tributaries.

Began April 1950, continuing; \$1500; R. E. Cleary and H. M. Harrison, Leaders; reports available.

Address inquiries to: E. B. Speaker, as in No. 7 above.

21. Winter Dissolved Oxygen Studies

The objective is to determine whether shallow lakes and streams should be open to promiscuous fishing. Dissolved oxygen samples are taken at regular intervals throughout the winter months on lakes and streams where fish populations are in danger of suffocation. When oxygen drops to near the lethal point, these areas are open to the public for promiscuous fishing to salvage the fish by spears, dip-nets, and other devices.

Began 1956, indefinite; \$3500; K. M. Madden and E. B. Speaker, Leaders.

Address inquiries to: E. B. Speaker, as in No. 7 above.

Iowa State College

1. Effects of Flood and Drought on Fish in an Intermittent Stream

Several species of fishes survive in intermittent streams. The present study was undertaken to determine where and how these fish survive the critical flood and drought periods. Methods of sampling these fish populations are being studied.

Iowa State Conservation Commission and U. S. Fish and Wildlife Service cooperating; Squaw Creek; began September 1953, closed July 1956; \$2500; Kenneth D. Carlander and Andreas A. Paloumpis, Leaders; reports available.

Address inquiries to: Kenneth D. Carlander, Department of Zoology and Entomology, Iowa State College, Ames, Iowa.

2. Populations and Movements of Channel and Flathead Catfish in Des Moines River, Boone County

In an attempt to get better methods of determining population abundance, several hundred channel and flathead catfish have been tagged with a strap tag on the operculum. Fish have been taken with hoop nets, seines, electric shocker, angling, and combined use of electric shocker and trammel nets.

Iowa State Conservation Commission and U. S. Fish and Wildlife Service cooperating; Boone County; began July 1954, to close March 1957; \$2800; Kenneth D. Carlander and R. Jess Muncy, Leaders; reports available.

Address inquiries to: Kenneth D. Carlander, as in No. 1 above.

3. Data on Fish Growth and Biology

Since fishery literature is so scattered, this project attempts to summarize all growth, length-weight, fecundity, population density and similar data on freshwater fishes of the United States and Canada and to publish tabular summaries in a Handbook and periodical supplements.

Iowa State Conservation Commission and U. S. Fish and Wildlife Service cooperating; Ames; began January 1947, indefinite; \$800; Kenneth D. Carlander

Leader; reports available.

Address inquiries to: Kenneth D. Carlander, as in No. 1 above.

4. Life History and Ecology of Carpsuckers, Carpiodes, spp.

The role of carpsuckers is little known, even though these fish are abundant in many Iowa catfish streams. The present study is an exploratory one to determine relative abundance, habitat selection, growth, and food habits of the species in the Des Moines River.

Iowa State Conservation Commission and the U. S. Fish and Wildlife Service cooperating; Des Moines River, Boone County; began October 1955, to close July 1957; \$2100; Kenneth D. Carlander and Marvin Buchholz, Leaders; reports available.

Address inquiries to: Kenneth D. Carlander, as in No. 1 above.

5. Survival and Growth of Young-of-the-year Fish

In an attempt to determine the factors which affect the abundance of year classes, the early life history of Clear Lake fishes is being investigated. Weekly collections are made at several portions of the lake, with emphasis on relative abundance, seasonal changes, growth, and food relationships.

Iowa State Conservation Commission, U. S. Fish and Wildlife Service, and Sport Fishing Institute cooperating; Clear Lake; began May 1956, to close March 1958; \$2200; Kenneth D. Carlander and Richard L. Ridenhour, Leaders; reports available.

Address inquiries to: Kenneth D. Carlander, as in No. 1 above.

6. Life History and Ecology of Clear Lake Minnows

Although several species of minnows are present in Clear Lake, none of them are very abundant, possibly due to predation by the game fish populations. The present study on the minnows includes weekly collections at several points to determine relative abundance, seasonal changes, growth, and food relationships.

Iowa State Conservation Commission, U. S. Fish and Wildlife Service, and Sport Fishing Institute cooperating; Clear Lake; began July 1956, to close July 1959; \$2200; Kenneth D. Carlander and James McCann, Leaders; reports available.

Address inquiries to: Kenneth D. Carlander, as in No. 1 above.

7. Walleye Fry Stocking in Clear Lake

Plantings of over 5,000 walleye fry per acre have been made in Clear Lake in the even numbered years since 1948 with no fry stockings in the odd numbered years, to test the effectiveness of annual fry stockings such as have been made since 1915. Scales are taken each year from adult fish to determine year class abundance and to see whether there is a corresponding alternation of abundant year classes.

Iowa State Conservation Commission and U. S. Fish and Wildlife Service cooperating; Clear Lake; began 1948, to close 1959; \$300; Kenneth D. Carlander, Leader; reports available.

Address inquiries to: Kenneth D. Carlander, as in No. 1 above.

8. Fish Population Changes in Clear Lake, Iowa

Annual Collections of scales, length-weight data, life history information, and gill net catch records have been made at Clear Lake each summer since 1947.

Iowa State Conservation Commission, U. S. Fish and Wildlife Service and Sport Fishing Institute cooperating; Clear Lake; began June 1947, indefinite;

\$1000; Kenneth D. Carlander, Leader; reports available.

Address inquiries to: Kenneth D. Carlander, as in No. 1 above.

9. Effects of Dredging on Shallow Prairie Lakes

The Iowa State Conservation Commission has dredged several shallow prairie lakes to decrease winterkill of fish, eliminate weedy shallows, and to increase recreational values. This study was initiated to investigate the biological effects of the dredging. Considerable attention has been placed on the development of more efficient sampling designs for estimating bottom fauna production. Food habits of the fish have been studied to determine the extent to which various bottom fauna organisms are utilized. Growth and population abundance of the principal fishes are also under study.

Iowa State Conservation Commission and U. S. Fish and Wildlife Service cooperating; North Twin Lake, near Rockwell City; began May 1951, closed December 1956; \$2200; Kenneth D. Carlander and John B. Owen, Leaders; reports available.

Address inquiries to: Kenneth D. Carlander, as in No. 1 above.

10. Gizzard Shad Ecology

In 1954, gizzard shad increased greatly in North Twin Lake which had been under study for 3 years and gave an opportunity to study the effects of the sudden overabundance. This project is designed to determine fish population dynamics and the ecology of gizzard shad.

Iowa State Conservation Commission and U. S. Fish and Wildlife Service cooperating; North Twin Lake, near Rockwell City; began June 1954, closed July 1956; \$2200; Kenneth D. Carlander and Joseph H. Kutkuhn, Leaders; reports available.

Address inquiries to: Kenneth D. Carlander, as in No. 1 above.

11. Creel Census Methods and Measurement of Sampling Errors

Clear Lake, Iowa, like many other lakes, has many access points and therefore a complete creel census is practically impossible. The present project is developing a sampling method which will give a maximum of unbiased data for estimating total harvest and success of fishing during the summer months. Fishermen counts are made according to a predetermined pattern. Boat livery records are compared to give an independent check on the estimates. Data are being evaluated to determine sizes of samples needed to get estimates within various confidence limits.

Iowa State Conservation Commission, U. S. Fish and Wildlife Service and Sport Fishing Institute cooperating; Clear Lake; began July 1953, closed December 1956; \$2200; Kenneth D. Carlander and Charles DiCostanzo, Leaders; reports available.

Address inquiries to: Kenneth D. Carlander, as in No. 1 above.

KANSAS

Forestry, Fish and Game Commission

1. Reclamation of Artificial Fishing Lakes

A reclamation project is initiated when periodic lake surveys indicate that the species composition and relative abundance of the fish of a lake are such that they are responsible for continued unsatisfactory fishing conditions. The fish populations are removed from such lakes by draining and seining, or through eradication with fish toxicants. Habitat improvement is practiced in

these lakes by the establishment of a vegetative cover on the exposed basins as a means of improving the fertility of the water when the lakes refill. After refilling, these lakes are properly restocked with largemouth bass, channel catfish, bluegills, and crappies.

Statewide; began July 1939, continuing; Roy Schoonover, Leader.

Address inquiries to: Dave Leahy, Director, Forestry, Fish and Game Commission, Pratt, Kansas.

2. Farm Pond Reclamation and Management Project

The Commission's objective in this program is to improve farm pond fishing over the State. The construction of better ponds with more emphasis on their use for recreation is being encouraged through educational and informational media.

The Commission cooperates with pond owners by assisting in the removal of the fish populations from old ponds so that restocking can be accomplished.

Other phases of the project are to make recommendations and give assistance on various management practices including the improvement of physical features of old ponds, aquatic plant control and the clearing of water in turbid ponds.

Statewide; began July 1948, continuing; Roy Schoonover, Leader.

Address inquiries to: Dave Leahy, as in No. 1 above.

3. Fish Population Control on Rooks County State Lake

In this 67-acre artificial lake a high percentage of the crappie, bluegill, and drum population was composed of small, slow-growing fish. The water level of this lake was low, 25 surface acres, enabling the removal of large numbers of these fish by a drag seine. The object of the project was to relieve competition on the remaining fish population with hopes of improving their growth rate. A follow-up age and growth study will be made to determine the feasibility of this type of operation during 1957. It is realized that seining is only a temporary measure for improvement even when large numbers of fish are removed, but a complete lake rehabilitation project wanted to be deferred until a desirable fish population was established in a newly created, nearby federal impoundment.

Began May 1956, closed May 1956; Frank Schryer, Leader.

Address inquiries to: Dave Leahy, as in No. 1 above.

4. Artificial Propagation of the Walleye

The objectives of the project were to determine if the walleye could be artificially hatched in Kansas, and to devise a technique for their production in adequate numbers. Spawners were captured by gill netting in the Fall River Reservoir. Walleye fry were successfully obtained, but egg handling methods from parent fish to hatching jar must be improved before substantial production can be achieved.

Fall River; began February 1956, indefinite; Frank Schryer, Leader.

Address inquiries to: Dave Leahy, as in No. 1 above.

5. Strip-mine Lake Survey and Management Project

Physical, chemical, and biological studies are being continued on the strip-mine water in southeastern Kansas for the purpose of collecting data needed as a basis for management procedures designed to develop greater fishing opportunities in this area.

Main emphasis is now being placed on the reclamation of strip-mine lakes for fishing, and on the use of practical management procedures which include total eradication of fish populations, spot eradication, and shoreline removal

with fish toxicants. These operations are followed by subsequent restocking or corrective stocking. This project has been expanded considerably and now includes several hundred acres of water owned by coal mining companies. Under the provisions of a cooperative agreement, the mining companies are permitting public access to these lakes which are being managed by the Commission.

More emphasis is now being placed on an evaluation of the results of this project. Test netting studies of lakes under management, growth-rate studies, and creel censusing are being used for this evaluation.

Kansas State Teachers College , Pittsburg, cooperating; southeastern Kansas; began June 1951, continuing; Charles Burner, Leader; reports available.

Address inquiries to: Dave Leahy, as in No. 1 above.

6. Construction of Public Fishing Lakes

The objective of this program is to create additional lakes to help satisfy the need for more fishing water in Kansas. The land is acquired and dams are constructed to provide artificial impoundments. As these lakes fill, warm-water species of fish including largemouth bass, channel catfish, crappie, and bluegill are stocked.

Statewide; began July 1953, continuing; Dave Leahy, Leader.

Address inquiries to: Dave Leahy, as in No. 1 above.

University of Kansas

1. Survey of Farm Ponds in Douglas County, Kansas

The study has three phases: (1) inventory of the number and sizes of farm ponds in the county, based upon aerial photographs made available by the U. S. Soil Conservation Service; (2) estimation of the real interest in pondfish production, based upon response to questionnaires sent to pond owners; (3) inquiry into the extent of application and results of pondfish-management recommendations that have been available to pond owners for several years, based upon personal interviews, and seining or poisoning of several ponds. Fish obtained from each pond are identified, and the relative abundance and growth rates of principal species are ascertained. Some ponds will later be used for experiments with different stocking combinations and management procedures.

Began September 1955, to close June 1957; \$2000; Claude Hastings, Leader.

Address inquiries to: Frank B. Cross, Museum of Natural History, University of Kansas, Lawrence, Kansas.

2. Parasites of Catfish in Eastern Kansas

This study seeks information on the incidence and kinds of parasitism in channel catfish, black bullheads, yellow bullheads, and certain other species of catfish, based upon specimens obtained from streams, farm ponds, and larger reservoirs in eastern Kansas.

Began April 1956, to close June 1957; \$500; Clarence Harms, Leader.

Address inquiries to: Frank B. Cross, as in No. 1 above.

3. Study of the Channel Catfish in Kansas

Evidence on the relative abundance and the growth rate of channel catfish in approximately 30 impoundments of varying sizes has been obtained, and is being interpreted in terms of (1) differences in physical characteristics of the impoundments, and (2) effects of transfer of stunted channel catfish from Kanopolis Reservoir to other Kansas impoundments. The latter aspect of the study relates to work reported as Project 1 of the Kansas Forestry, Fish and

## KANSAS (Cont.)

Game Commission in the Survey of Sport Fishery Projects for 1954. Most studies have dealt with the larger reservoirs under public ownership, but some information has been gathered on spawning success and growth made by channel catfish in small farm ponds, as well. Fish have been marked by use of opercle-tags or clipped fins, and some have been held under observation to ascertain the length of retention of such marks.

Kansas Forestry, Fish and Game Commission cooperating; statewide; began February 1954, to close February 1957; \$4,320; W. Jackson Davis, Leader; reports available.

Address inquiries to: Frank B. Cross, as in No. 1 above.

### 4. Fishes of Kansas

This project is an inventory of the fishes of the State, and is to include descriptions (with keys), distribution maps, and notes on the habitat and abundance of each species. To date, preliminary keys and distribution maps have been prepared, and illustrations have been completed for 60 species, approximately half the number known from Kansas. Collecting of fishes and compilation of pertinent literature continue.

Statewide; began July 1951, to close 1958; \$500; Frank B. Cross, Leader.

Address inquiries to: Frank B. Cross, as in No. 1 above.

## KENTUCKY

### Department of Fish and Wildlife Resources

#### 1. Warm-water Stream Investigations

The objective is to determine the effectiveness of total population eradication and restocking in two streams. During the four years of study there has been a gradual reversion to the original population composition. The study will also determine the effectiveness of partial population removal in a stream. Evidence indicates that this method holds little promise as a desired management tool.

North Fork River, Whippoorwill Creek, Floyd's Fork Creek; began February 1952, to close March 1957; \$12,070; James R. Charles, Leader; reports available.

Address inquiries to: Minor Clark, Director, Division of Fisheries, Frankfort, Kentucky.

#### 2. Farm Pond Investigations

This project is to determine the species of fish stocking rates which should be applied to provide maximum fishing success in Kentucky farm ponds.

The State was divided into six regions based on soil types. In each soil region a series of ponds has been stocked with various bluegill and largemouth bass or shellcracker and bass combinations each year for the past five years. Each summer these ponds are test seined to determine balance and scale samples are taken from several selected ponds to check growth rates. These data are analyzed to determine the species combination and soil type that registers the highest degree of success.

Statewide; began November 1950, to close May 1958; \$22,000; John F. Hall, Leader; reports available.

Address inquiries to: Minor Clark, as in No. 1 above.

## KENTUCKY (Cont.)

### 3. Small Lake and Stream Investigation and Management

The project contains three objectives: (1) To determine by the mark and recovery method and subsequent total eradication of the pond's fish population, the standing crop (pounds of fish per acre) in the different soil regions of Kentucky. (2) To determine the best kinds, proper amounts and best methods of application of rotenone to insure eradication of total population of fish when restocking is the desired method of producing a desirable fish population. Eight methods of application, three concentrations and three different poisons are being used. (3) To determine the general population composition of a number of streams in Kentucky. An electric seine and rotenone are being used.

Statewide; began September 1955, to close 1958; \$13,000; James B. Kirkwood, Leader.

Address inquiries to: Minor Clark, as in No. 1 above.

### 4. Investigations and Management of the Herrington Lake Fishery

The chief objective of the project is to gather basic information for use in the evaluation of various management measures contemplated. To this end, an extensive creel census is in progress. Also, age and rate of growth of the more important game and pan fishes are being determined by scale methods, and the species composition of the fish population is to be determined within the limitations of rotenone cove sampling.

Selective rotenone poisoning of gizzard shad is being investigated as a management tool for the Herrington Lake fishery. The effectiveness of aerial applications of powdered and emulsifiable rotenone, as well as sub-surface applications of rotenone, for shad control are being evaluated.

Herrington Lake; began March 1956, to close February 1958; \$19,000; William A. Smith, Jr., Leader.

Address inquiries to: Minor Clark, as in No. 1 above.

## LOUISIANA

### Wild Life and Fisheries Commission

#### 1. Fish Population Investigation

The objective is to gather information relative to status of fish populations in Louisiana. Included in this project are reproduction studies, determination of growth rate of young of the year largemouth bass, white crappie and black crappie; age and growth studies, tagging studies, and comparison of estimated age and growth rate of fish with their known age and growth.

Statewide; began February 1953, to close June 1958; \$50,000; Victor Lambou, Leader.

Address inquiries to: Victor Lambou, Route 3, Perkins Road, Baton Rouge, Louisiana.

#### 2. Fish Populations and Aquatic Conditions in Polluted Waters

The objective is to compile accurate and reliable data on the effects of industrial wastes on the aquatic flora and fauna. An over-all limnological, biological and ecological study is being conducted on the Ouachita River in northeast Louisiana.

Ouachita River; began July 1954, to close June 1958; \$22,437; James T. Davis, Leader.

Address inquiries to: James T. Davis, Monroe Fish Hatchery, Sterlington Road, Monroe, Louisiana.

3. An Evaluation of Commercial Gear

The objective is to test the various types of gear available to determine the most effective gear for removal of commercial, forage, and trash species.

Statewide; began September 1955, to close September 1957; \$23,207;

James T. Davis, Leader.

Address inquiries to: James T. Davis, as in No. 2 above.

MAINE

Department of Inland Fisheries and Game

1. A Study of Lake Trout in Thompson Lake

This project was designed to parallel corresponding work conducted on Cold Stream Pond, Enfield, Maine, to ascertain whether or not similar results would be obtained.

Lake trout are trapped and tagged, weighed, and measured on the annual spawning migrations each fall. Creel census data, taken both summer and winter, will provide data sufficient for population estimates and migration studies. Intensive field work on the lake will provide additional information relative to food studies, age and growth, population density, and seasonal depth variations due to food requirements.

University of Maine cooperating; Androscoggin and Cumberland Counties; began October 1955, to close September 1959; \$1,873; Stuart E. DeRoche, Leader; reports available.

Address inquiries to: Stuart E. DeRoche, 19 Joy Street, Springvale, Maine.

2. Socatean Stream Trout Study

The objectives are: (1) To determine the migration dates and water temperatures of spawning trout from Moosehead Lake. (2) To determine the migration dates of young trout returning to the lake. (3) To evaluate the contribution of the stream to the lake fishery. (4) To determine the ratio of stream resident trout to migrating fish. (5) To provide additional data on the success of natural reproduction. A weir has been constructed and operated this year and will be for three years.

University of Maine cooperating; began July 1956, to close November 1960; \$3,000; Roger P. AuClair, Leader.

Address inquiries to: Roger P. AuClair, Box 146, Rockwood, Maine.

3. Age and Growth of Smelt in Maine Inland Waters

The objectives are: (1) To determine if the size difference exhibited by various smelt populations in inland waters are the result of variations in growth rate. (2) To determine the average life span of smelt in inland waters. (3) To determine age at maturity. (4) To determine if there are significant differences in time and extent of spawning migrations of various size and age groups.

University of Maine cooperating; statewide; began May 1955, to close May 1958; \$4,500; Robert S. Rupp, Leader; reports available.

Address inquiries to: Robert S. Rupp, Fishery Office, University of Maine, Orono, Maine.

4. Investigation of Philonemiasis in Salmonids

The project involves a life history study of the dracunculid nematode, Philonema agubernaculum Simon and Simon, 1936, and the pathological affects upon its hosts, i. e. , the landlocked salmon (Salmo salar) and the

brook trout (Salvelinus fontinalis). An attempt is being made to determine when the host first normally acquires the infection, and whether the fish used in the stocking program harbor the parasite. If it is found that the fish acquire the infection prior to being released, the present hatchery practices might possibly be altered so as to produce *P. agubernaculum*-free fish.

Oquossoc; began June 1956, indefinite; \$2,200; W. Harry Everhart, Leader.

Address inquiries to: Marvin C. Meyer, 23 Coburn Hall, University of Maine, Orono, Maine.

5. An Investigation of Landlocked Salmon in the Fish River Chain of Lakes

This project is designed to gather information on reproduction, migration, early life history, age and growth, and survival of stocked hatchery salmon and will contribute to better management of this species in the study waters and statewide. Trap nets have been operated during the spawning season on a major spawning thoroughfare to obtain detailed data on the spawning migration, reproduction, and characteristics of the spawning run. Scale samples have been collected from the spawning run and by creel census to evaluate age composition and growth characteristics. All hatchery salmon stocked in the Chain of Lakes will be marked for a 3-year period. Evaluations of the contribution of stocked fish to the salmon fishery will be made by creel census, voluntary returns and test netting.

University of Maine cooperating; Aroostook County; began July 1955, to close June 1958; \$2,000; Kendall Warner, Leader; reports available.

Address inquiries to: Kendall Warner, Ashland, Maine.

6. An Investigation of the Fresh-water Fisheries of Mount Desert Island

The objectives are: (1) To re-establish an alewife population in Long Pond, Mt. Desert, by stocking ripe adults. The progeny (of stocked spawners) returning as adults are being counted. (2) To study returns to the creel, survival, and spawning habits of marked hatchery-reared brook trout and lake Atlantic salmon by stream trapping and creel census.

University of Maine cooperating; Hancock County; began May 1950, closed December 1956; \$2,500; Keith A. Havey, Leader; reports available.

Address inquiries to: Keith A. Havey, 31 Center Street, Machias, Maine.

7. Preliminary Investigations of Anadromous Brook Trout Populations in Maine

The objective is to determine the magnitude, distribution, and characteristics of anadromous brook trout populations in coastal Maine. Electro-fishing and permanent two-way fish traps are being utilized to conduct the study.

University of Maine cooperating; eastern and southern Maine; began April 1956, to close December 1960; \$3,000; Keith A. Havey, Leader.

Address inquiries to: Keith A. Havey, as in No. 6 above.

8. Statewide Lake and Stream Investigations

The objective is to evaluate basic physical, chemical, and biological characteristics of Maine lakes and streams including: (a) Physical and chemical characteristics of Maine lakes and streams in relation to species suitability and productivity, (b) population studies of lakes and streams, and (c) age and growth studies of important species.

University of Maine cooperating; statewide; began April 1951, continuing; \$40,000; W. Harry Everhart, Leader; reports available.

Address inquiries to: Lyndon H. Bond, Fish and Game Department, State House, Augusta, Maine.

9. Atlantic Salmon Restoration

Restoration of the Atlantic salmon requires habitat restoration to provide free migration for the adults and young. Migrations are influenced by obstructions, pollution, and minimum flows. River drainages are inventoried in entirety and this background information provides the basis for recommendations for improving the runs. Electro-fishing on standardized test areas is conducted each field season to measure population trends in the young fish. Several weirs are maintained and several traps are operated in fishways. Research is confined to a year around operated counting weir on the Edmunds Unit of the Moosehorn Wildlife Refuge, and a unit productivity study on a tributary to the Penobscot River. The hatchery stock necessary for introductions to restored areas is obtained and reared by the Fish and Wildlife Service at their East Orland Fish Cultural Station. Hatchery fish are marked prior to stocking.

U. S. Fish and Wildlife Service cooperating; headquarters - University of Maine; began July 1948; \$22,000; W. Harry Everhart, Leader; reports available.

Address inquiries to: W. Harry Everhart, Fishery Office, University of Maine, Orono, Maine.

10. Chemical Reclamation of Small Ponds for Trout

Natural ponds open to public fishing will be chemically reclaimed with rotenone compounds and subsequently managed for trout to improve the quality of fishing.

U. S. Fish and Wildlife Service cooperating; statewide; began 1955, continuing; \$17,000; Robert E. Foye, Leader; reports available.

Address inquiries to: Robert E. Foye, Fishery Biologist, Maine Department of Inland Fisheries and Game, State House, Augusta, Maine.

U. S. Fish and Wildlife Service, Branch of Fishery Biology

1. Atlantic Salmon Investigations

This is a cooperative study of the estuary of the Sheepscot River to determine its importance in relation to Atlantic salmon. Studies include currents, salinity, river discharge, temperature, bottom fauna, alewives, smelt, herring, clams, marine worms, as well as salmon. River studies include estimation of spawning population and determining time and extent of seaward migration of smolts by means of an upstream-downstream weir which was installed in 1956.

Maine Department of Sea and Shore Fisheries, Maine Department of Inland Fisheries, Maine Sea Run Salmon Commission, and the U. S. Fish and Wildlife Service Clam and Herring Investigations cooperating; headquarters - Boothbay Harbor; began January 1955, continuing; \$10,000; Walter R. Welch, Leader; reports available.

Address inquiries to: Walter R. Welch, Project Leader, Clam and Atlantic Salmon Investigations, U. S. Fishery Laboratory, Boothbay Harbor, Maine.

MARYLAND

Department of Research and Education

1. Study of Fish Movements

The objectives are: (1) To develop a technique for following moving fish, and (2) to use this technique to learn movement patterns of fish in impoundments, especially Deep Creek Lake, to permit more intensive harvest of these fish.

MARYLAND (Cont.)

Deep Creek Lake; began June 1956, to close October 1957; \$600; Harold J. Elser, Leader.

Address inquiries to: Harold J. Elser, Department of Research and Education, Solomons, Maryland.

2. Investigations of Growth Rates of Fish in Fresh Waters of Maryland

This project is designed to estimate the growth rates of fish in various fresh waters as a reflection of the environmental conditions.

Statewide; began 1948, to close 1958; Harold J. Elser, Leader.

Address inquiries to: Harold J. Elser, as in No. 1 above.

3. Investigation of Fish Population Structures in Fresh Waters of Maryland

The objective is to determine the relation between population structure and goodness of fishing.

Statewide; began September 1955, to close 1958; Harold J. Elser, Leader; reports available.

Address inquiries to: Harold J. Elser, as in No. 1 above.

4. Investigations Useful for Fisheries Management of Deep Creek Lake

The objectives are to estimate the harvest of fish, to learn the population structure, and to find out how to improve the population structure. The study also concerns movements, spawning habits, and susceptibility to poisons of undesirable species, especially yellow perch.

Deep Creek Lake and Solomons; began 1948, indefinite; \$2,000; Harold J. Elser, Leader; reports available.

Address inquiries to: Harold J. Elser, as in No. 1 above.

5. Life History of the White Perch in Maryland Waters With Special Reference to the Patuxent River

The objectives are: (1) To learn the reproductive behavior, early development, and factors, such as salinity and temperature, that are important in the biology of white perch; (2) to determine the movements on a seasonal basis by the mark and recapture method in the Patuxent River; (3) to determine the age distribution and growth of fish, to learn the occurrence of dominant year classes, and to elucidate other features in populations of white perch collected over a period of five years by means of scale analysis; (4) to determine the food habits on a seasonal basis and in different parts of its range in estuaries, the occurrence of parasites, and other features in its life history.

Johns Hopkins School of Hygiene and Public Health cooperating; Chesapeake Biological Laboratory; began 1952, to close 1957; Romeo Mansueti, Leader.

Address inquiries to: Romeo Mansueti, Chief Fish Biologist, Chesapeake Biological Laboratory, Maryland Department of Research and Education, Solomons, Maryland.

6. Preparation of Detailed Descriptions, Diagnostic Keys, and Scientific Illustrations of the Various Stages of Fish Eggs, Larvae and Juveniles in the Identification of Important Species of Chesapeake Bay and Tributaries

The objectives are: (1) To depict the species-specific features of the developmental stages of fish so that when they are combined with descriptions they will provide a basis for identification; (2) to fill in the gaps in the knowledge of the early developmental stages of all species that spawn in Chesapeake Bay and tributaries so that it will be possible to extend studies of the critical early developmental period in fishes; (3) to obtain and rear from known species the eggs to the juvenile stage where identification is no longer questionable.

National Science Foundation cooperating; Chesapeake Biological Laboratory; began Summer 1954, continuing; Romeo Mansueti, Leader.

Address inquiries to: Romeo Mansueti, as in No. 5 above.

7. A Study of the Distribution of Juvenile Yellow Perch in the Severn and Patuxent Rivers

The objectives are (1) to ascertain the distribution of juvenile yellow perch in these rivers and to decide the conditions in which they are found; and (2) to find a means of predicting where juvenile yellow perch can be found in Maryland tidewater rivers other than the test areas.

Chesapeake Biological Laboratory; began 1954, continuing; Romeo Mansueti, Leader.

Address inquiries to: Romeo Mansueti, as in No. 5 above.

8. A Survey of the Volumes of Yellow Perch Spawn in Various Tidewater Streams

The objectives are: (1) To develop and evaluate methods of estimating yellow perch spawn volumes in streams; (2) to obtain some measure of the amount of spawning occurring in tidewater streams; (3) to translate these volumes into numbers of eggs; and (4) to compare these numbers with the numbers customarily produced and planted from the Severn Run hatchery.

Chesapeake Biological Laboratory; began Spring 1954, continuing; Romeo Mansueti, Leader.

Address inquiries to: Romeo Mansueti, as in No. 5 above.

9. A Study of Maryland's Yellow Perch Hatchery Operation

The objective is to evaluate the existing techniques used and the practicality of hatching and planting yellow perch in Maryland.

Chesapeake Biological Laboratory; began 1954, continuing; Romeo Mansueti, Leader.

Address inquiries to: Romeo Mansueti, as in No. 5 above.

10. Patuxent River Spawning Area Study

The objectives are: (1) To estimate the total egg production by striped bass during an entire spawning season in the Patuxent River; (2) to develop means of evaluating other surveys of striped bass spawning areas; (3) to provide bases for planning effective programs for future surveys of striped bass spawning with minimum effort and good estimates of the errors involved; and (4) to determine accurately the relationships between striped bass spawning, temperature, and salinity.

Chesapeake Biological Laboratory; began spring 1953, continuing; Romeo Mansueti, Leader.

Address inquiries to: Romeo Mansueti, as in No. 5 above.

11. An Annotated Account of the Fishes and Fish-Like Craniates of the Fresh Waters of Maryland and the District of Columbia

The objectives are: (1) To summarize the 1949, 1950, and 1951 statewide ichthyological surveys made in inland waters; (2) to make a much needed contribution to the analysis of the distribution of the present fresh water fish fauna; (3) to make available a diagnostic key and illustrations for the identification of fresh water forms for the first time in a study of Maryland fishes, thereby complementing Hildebrand and Schroeder (1928) which contains keys to estuarine fishes in Chesapeake Bay; and (4) to review past records of fishes and to trace generally the history of the growth of knowledge from the earliest reference to the present.

Maryland Game and Inland Fish Commission cooperating; Chesapeake

Biological Laboratory; began Summer 1949, to close August 1953; Romeo Mansueti, Leader.

Address inquiries to: Romeo Mansueti, as in No. 5 above.

12. Maryland Potomac River Inland Fishery Investigations

The objectives are: (a) To determine the peak of smallmouth bass spawning season and related information pertaining to associated species; (b) to study gonad development through collections for the purpose of relating this information to objective one; (c) to study age, growth, and condition factors; (d) to make population analyses through migration and quantitative and qualitative examination of the smallmouth bass fishery; (e) to estimate fishing pressure and total harvest of fish in a 2-mile radius of Lander, on the Potomac River.

University of Maryland cooperating; Montgomery, Frederick, Washington, and Allegany Counties; began May 1956, to close June 1957; \$12,993; Albert E. Sanderson, Jr., Leader.

Address inquiries to: Albert E. Sanderson, Jr., Biologist, Beaver Creek Hatchery, R. D. No. 1, Hagerstown, Maryland.

13. An Investigation of Striped Bass

The objectives are: (1) To compare the contribution of each area to the total of the striped bass population; (2) to analyze the effect of licensed and unlicensed net fishing in spawning areas; (3) to determine the upper and lower limits of striped bass spawning in each of the major rivers; (4) to determine the times at which spawning begins and ends and the peaks of spawning intensity in major rivers of Maryland; (5) to determine the migration patterns of striped bass in and from Maryland waters; (6) to determine whether there is any merit in protecting striped bass over 15 pounds; and (7) to determine the extent of predation of each size category on other commercial species.

University of Maryland and U. S. Fish and Wildlife Service cooperating; Chesapeake Bay and Esterian Rivers; began June 1956, to close July 1957; \$14,000; Edgar H. Hollis, Leader.

Address inquiries to: Edgar H. Hollis, Department of Tidewater Fisheries, State Office Building, Annapolis, Maryland.

University of Maryland

1. A Study on the Gonads of the Striped Bass, Roccus saxatilis, in Chesapeake Bay

The purpose of the study is to determine the potential spawning of the striped bass by egg size and egg counts, and if possible to determine the relative viability of the large eggs in different sized fish.

Maryland Department of Tidewater Fisheries cooperating; Chesapeake Bay; began August 1955, to close June 1957; J. Frances Allen, Leader.

Address inquiries to: J. Frances Allen, Department of Zoology, University of Maryland, College Park, Maryland.

2. A Study of the Endocrine Organs of the Striped Bass, Roccus saxatilis

A study of the morphology and histology of the thyroid, pituitary and gonads. This is to include the use of certain histochemical techniques to determine if the physiological state of the cells can be estimated. The series to be used will include as wide a size range of fish as can be obtained as well as seasonal samples.

The objectives include study of the development of the above-named structures including size, age and sex variations, and seasonal cycle as can be correlated from the above structures. These are to be interpreted in terms of the reproductive potential of the various size fish if possible.

## MARYLAND (Cont. )

Maryland Department of Tidewater Fisheries cooperating; began July 1955, to close June 1958; \$1,565; Gordon M. Ramm, Leader.

Address inquiries to: J. Frances Allen, Department of Zoology, University of Maryland, College Park, Maryland.

## MASSACHUSETTS

### Division of Fisheries and Game

#### 1. Evaluation of Stream Reclamation for Trout

In 1955, three small streams were reclaimed and subsequently stocked with fingerling trout, plus catchables the following spring. These streams were inventoried in the summer of 1956 using various fish sampling gear. Results were compared with original survey findings, fish samples collected at the time of reclamation, or both.

Statewide; began August 1955, closed September 1956; \$500; James W. Mullan, Leader.

Address inquiries to: James W. Mullan, Division of Fisheries and Game, Field Headquarters, Westboro, Massachusetts.

#### 2. Individual Pond and Lake Fliers for Distribution to the Public

The objective is to keep the general public abreast of past, present, and future management of 56 specific ponds and lakes, and to stimulate greater harvests of panfishes in some of these waters. Individual one page fliers showing location, access, facilities available, stocking history, and other pertinent information relative to fishing were drawn-up. Some 36,000 copies were printed and are in the course of being distributed free of charge.

Headquarters - Westboro; began February 1956, closed April 1956; \$1,000; James W. Mullan, Leader; reports available.

Address inquiries to: James W. Mullan, as in No. 1 above.

#### 3. Trout Pond Reclamation

Ten ponds totaling 310 surface acres have been claimed for brook, brown, and rainbow trout. In addition, appropriate research data on mortality, growth, and fishing success for trout fingerlings stocked in reclaimed waters is being accumulated. This is being done by reclaiming and recovering the trout populations from a few previously renovated waters. On some of these waters angler harvest has been followed through creel census.

Statewide; began September 1950, continuing; \$11,000; James W. Mullan, Leader.

Address inquiries to: James W. Mullan, as in No. 1 above.

#### 4. Stream Investigations

The objective is to obtain information for the management of so-called "salter trout". In 1956, this project consisted of two phases. One phase consisted of the intensive study of four known salter streams through stocking marked fish, creel checks, and population inventory with the electric shocker. The other phase consisted of a reconnaissance survey of most coastal streams to learn whether any of these could be profitably managed for salter brook trout.

Coastal streams; began January 1952, closed December 1956; \$15,000; John H. Ryther, Leader; reports available.

Address inquiries to: John H. Ryther, Woods Hole Oceanographic Institute, Woods Hole, Massachusetts.

5. Quabbin Reservoir Investigations

Creel census and population studies on 25,000-acre Quabbin Reservoir were instigated in 1954 and carried through to date to obtain information relative to harvest, composition, angler success, soundness of regulations, and success of introduced walleyes and lake trout. Results indicate that the experimental spring bass fishing allowed during the last two years has had no detrimental affects on the fisheries. Growth of stocked lake trout is satisfactory and a few are starting to come into the angler catch. The fate of stocked walleyes is not known as yet.

Central Massachusetts; began 1954, to close 1958; \$7,000; Robert McCaig, Leader; reports available.

Address inquiries to: Robert McCaig, Division of Fisheries and Game, Field Headquarters, Westboro, Massachusetts.

6. Creel Census of an Intensively Fished "Two Story" Trout Pond

This project involves gathering angler harvest data on Asnacomet Pond (127 acres) which is currently being managed for trout by stocking large size catchable brown and rainbow trout for two years prior to reclamation and for two years after. This year marked the first year of the creel census.

Asnacomet Pond; began April 1956, to close October 1959; \$3,000; Robert McCaig, Leader.

Address inquiries to: James W. Mullan, as in No. 1 above.

7. Ice Creel Census of Three Large Lakes

The objectives are to determine the extent and nature of winter ice fishing on these waters, composition of the catch, and the suitability of regulations as they apply to winter fishing. This is a continuing project which has been in operation for three seasons. Primary information sought revolves about chain pickerel.

Lake Onota, Pontoosuc Lake and Cheshire Reservoir; began December 1953, to close March 1963; \$1,600; James W. Mullan, Leader.

Address inquiries to: James W. Mullan, as in No. 1 above.

8. The Selective Poisoning of a Large "Two Story" Trout Pond

Cliff Pond, having 193 surface acres with maximum and coverage depths of 88 and 32 feet, respectively, was successfully partially poisoned in mid-August 1956, to reduce the warm water fish present and improve trout fishing. This was done by treating the epilimnion with emulsifiable rotenone. Gill netting and creel checking indicated a good trout population present, yet only one 10-inch brown trout was killed out of a total of 8,300 pounds of other fishes destroyed.

Cliff Pond; began August 1956, closed August 1956; \$2,000; James W. Mullan, Leader; reports available.

Address inquiries to: James W. Mullan, as in No. 1 above.

Bureau of Wildlife Research and Management

1. Warm Water Pond Reclamation

The objective is to reclaim 12 warm water lakes or ponds, comprising 762 acres, with rotenone during 1956 and restock them with suitable combinations of game and panfishes. Ponds to be reclaimed have been found to be low in predators or game fish and high in undesirable pan or trash fishes.

Statewide; began September 1950, continuing; \$11,000; Frank Grice, Leader; reports available.

Address inquiries to: Frank Grice, Division of Fisheries and Game, Field Headquarters, Westboro, Massachusetts.

MASSACHUSETTS (Cont.)

2. Evaluation of Warm Water Reclamation

The objective is to evaluate the success or failure of the warm water reclamation project, including stocking rates, species combinations, effects of recontamination by other species, growth rates of fishes involved, recruitment, and angling success.

Creel censuses, test netting and spot-poisoning with rotenone are being utilized to gather statistics on reclaimed waters. A total of 57 lakes or ponds are involved in this project.

Statewide; began September 1950, continuing; \$6,000; Frank Grice, Leader; reports available.

Address inquiries to: Division of Fisheries and Game, Field Headquarters, Westboro, Massachusetts.

3. Evaluation of Fyke-Netting to Control Over-Abundant Pan and Trash Fishes

The objective is to determine what effect pan and trash fish thinning with fyke nets has on population structure, age and growth, and fishing success. The effect and costs of this work will be compared to partial poisoning to determine which of these methods of control are the most applicable. About 12 lakes comprising 1500 or more acres are involved in this project.

Statewide; began September 1950, continuing; \$8,000; Frank Grice, Leader; reports available.

Address inquiries to: As in No. 2 above.

4. Evaluation of Partial Poisoning as a Method of Improving Warm Water Fishing

Age and growth studies, species composition, and fishing success before and after partial poisoning are being evaluated. In some of the ponds, game fish stocking follows treatment, in others natural recruitment is relied upon to fill the void created in the population. Ponds and lakes with varying species compositions are being studied to assess the effect on these various populations. Approximately eight units involving 1100 acres are involved in this study.

Statewide; began September 1950, continuing; \$2,000; Frank Grice, Leader; reports available.

Address inquiries to: Frank Grice, as in No. 1 above.

Woods Hole Oceanographic Institution

1. Biology of the Larger Pelagic Fishes of the Western Atlantic

The project is concerned especially with the tunas, marlins, sailfish, dolphins and carangids, particularly with their reproduction, growth from early stages to maturity, distribution, migrations, and feeding habits.

Nova Scotia to Gulf of Mexico; began January 1956, to close December 1958; \$10,000; William C. Schroeder, Leader.

Address inquiries to: William C. Schroeder, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts.

University of Massachusetts

1. Management Studies on a Western Massachusetts Marginal Pond

The objectives of this project are to furnish brown trout fishing in a pond which has low priority for this species. The pond was poisoned in 1948 and again in 1953 to destroy the abundant crop of suckers, bullheads and other warm water fishes. The pond has been stocked each spring with brown trout, and a voluntary creel census has been kept of the number of hours fished and the fish taken out each year.

Department of Conservation cooperating; Franklin County; began January

MASSACHUSETTS (Cont.)

1948, continuing; \$200; R. E. Trippensee, Leader.

Address inquiries to: Forestry and Wildlife Management Department, University of Massachusetts, Amherst, Massachusetts.

U. S. Fish and Wildlife Service, Branch of Game-fish and Hatcheries

1. Fishery Management Surveys

The objective is to develop fish management plans, based on surveys, for specific water areas. Priority is given to Federally controlled areas such as Service refuges, National Forests, Veterans Administration facilities, defense installations, and Indian reservations.

Headquarters - Boston, field work in the several states comprising Fish and Wildlife Service Region 5; continuing; James C. Otis and Paul L. Hooper, Leaders. Field Offices; Warren, Pennsylvania; Joseph A. Bocardy, Leader and Elkins, West Virginia, Jack D. Larmoyeux, Leader.

Address inquiries to: Regional Director, Fish and Wildlife Service, 1105 Blake Building, 59 Temple Place, Boston 11, Massachusetts.

2. Technical Assistance in Fish Cultural Activities

Assistance is given to fish cultural personnel toward the solution of biological problems of hatchery management, such as weed control, fertilization, disease, and water quality; and in initiating new or improved techniques. Fish stocking activities are reviewed for correlation with State Conservation Department practices and to direct the distribution of Federally produced fish in accordance with Fish and Wildlife Service policy and known fishery management needs.

Headquarters - Boston; field work in the several states comprising Fish and Wildlife Service Region 5; continuing; James C. Otis and Paul L. Hooper Leaders. Field Offices: Warren, Pennsylvania; Joseph A. Bocardy, Leader, and Elkins, West Virginia, Jack D. Larmoyeux, Leader.

Address inquiries to: As in No. 1 above.

U. S. Fish and Wildlife Service, Office of River Basin Studies

1. Survey of Finfish and Shellfish Resources of Narragansett Bay in Relation to Proposed Hurricane Damage Control Barriers

The project involves an inventory of the marine life of Narragansett Bay, its utilization, and the ecological relationships of the fauna of the area. Research into the characteristics of the macroinvertebrate life of the Bay and studies of the tolerances of the hard clam to various influences will be undertaken. The ultimate objectives are to determine the probable impact of hurricane control structures on the Bay's fauna, devise methods to mitigate any undesirable impacts and enhance desirable ones, and develop a comprehensive record of pre-development conditions in the Bay for post-development reference and comparison.

Rhode Island Division of Fish and Game and the University of Rhode Island cooperating; Narragansett Bay, Rhode Island and Massachusetts; began April 1956, indefinite; \$20,000; John E. Watson, Leader.

Address inquiries to: Regional Director, U. S. Fish and Wildlife Service, 59 Temple Place, Boston, Massachusetts.

2. Allegheny River Creel Census

The objective of this project is to develop a pre-impoundment assessment of the fishery resources which would be affected by the contemplated Allegheny River Reservoir. A similar project will be undertaken several years after the project is constructed, provided development of the site occurs.

MASSACHUSETTS (Cont.)

Headquarters - Boston; Allegheny River and tributaries between Warren, Pennsylvania and Salamanca, New York; began June 1956, to close November 1957; \$4,500; Benjamin F. Donley, Leader.

Address inquiries to: As in No. 1 above.

MICHIGAN

Department of Conservation

1. White River Watershed

This is an operational program designed to improve fishing conditions by the installation of practices and devices on both the uplands and the stream channels of the watershed. Work includes stream improvement structures (deflectors, covers, dams, etc.), bank stabilization, stream side tree planting, stream side fencing, and cattle crossings. The upland work consists of gully control (check dams, tree planting, and fencing).

Newaygo County; began July 1955, continuing; \$32,700; Wayne H. Tody, Leader; reports available.

Address inquiries to: Wayne H. Tody, Water Conservationist, Department of Conservation, Lansing 26, Michigan.

2. Pine Creek Watershed

This is an operational land use program designed to improve fishing conditions by the installation of practices and devices on both the uplands and the stream channels of the watershed. Work includes stream improvement structures (deflectors, covers, dams, etc.), bank stabilization, stream side tree planting, fencing, and cattle crossings. The upland work consists of tree planting, fencing, and gully control.

Dickinson County; began June 1955, continuing; \$31,000; Wayne H. Tody, Leader; reports available.

Address inquiries to: Wayne H. Tody, as in No. 1 above.

3. Lake Inventory

The project is a physical-chemical-biological survey of lakes on a state-wide basis to obtain basic information for the management program. Growth rates and habitat requirements of the fish fauna are determined.

Statewide; began 1932, continuing; \$22,774; C. M. Taube, Leader; reports available.

Address inquiries to: Institute for Fisheries Research, University Museums Annex, Ann Arbor, Michigan.

4. Stream Inventory

A physical-chemical-biological survey of streams is conducted to obtain basic information for the management program. Distribution and growth habits of stream fish fauna are determined.

Statewide; began 1952, continuing; \$18,978; C. M. Taube, Leader; reports available.

Address inquiries to: As in No.3 above.

5. Mapping During Open Water Season

The project provides maps which show size, depth, shape, and bottom types of inland lakes. Maps are prepared through use of aerial photographs and echosounder. They are prepared for use in the management program and for distribution.

MICHIGAN (Cont.)

Statewide; began 1953, continuing; \$5,693; C. M. Taube, Leader; reports available.

Address inquiries to: As in No. 3 above.

6. Lake Mapping in Winter

The project provides maps of inland lakes showing shape, size, depths, and bottom soil types. Maps are prepared for use in the management program and for distribution.

Statewide; began 1939, continuing; \$21,255; C. M. Taube, Leader; reports available.

Address inquiries to: As in No. 3 above.

7. Age and Growth of Michigan Game Fishes

The objective is to determine the statewide average growth and sex ratio of each species for comparisons between waters, and to compare growth in individual waters with statewide averages. Growth in individual waters will be assessed as an evaluation of management practices.

Statewide; began 1932, indefinite; \$8,350; William C. Latta, Leader; reports available.

Address inquiries to: As in No. 3 above.

8. Age and Growth Studies, Hunt Creek

Growth analysis is made of brook trout in angler's catch from various experimental waters and of residual population.

Hunt Creek Trout Experiment Station; began 1950, continuing; \$6,832; David S. Shetter, Leader; reports available.

Address inquiries to: As in No. 3 above.

9. Age and Growth, Northern Pike

By using pike of known age and wild specimens, valid methods of age determinations are developed. Statewide age and growth averages are compiled for comparative purposes.

Statewide; began 1950, to close 1957; \$759; John E. Williams, Leader; reports available.

Address inquiries to: As in No. 3 above.

10. Trout Migration Studies, Hunt Creek

The extent of movement into or out of experimental sections of Hunt Creek is determined by operation of weirs and maintenance of marking records.

Montmorency County; began 1949, continuing; \$8,350; David S. Shetter, Leader; reports available.

Address inquiries to: As in No. 3 above.

11. Walleye Sport Fishery, Muskegon River System

This study of the walleye fishery on the Muskegon River system is concerned with the effectiveness of power dams as barriers, effect of turbines on walleyes passing through them, fate of immature walleyes in Hardy Reservoir, possibility of using an electric screen for walleyes, and magnitude and exploitation of spawning run. Most of these data are secured from tagging studies.

Lower Muskegon River; began 1947, continuing; \$380; Walter R. Crowe, Leader; reports available.

Address inquiries to: As in No. 3 above.

12. Walleye Tagging, Inland Waterway

Through tagging studies in waters of the inland waterway the need for special regulations, extent of exploitation, walleye abundance, and migration pattern within the system is determined.

Cheboygan and Presque Isle Counties; began 1953, continuing; \$380; Walter Crowe, Leader.

Address inquiries to: As in No. 3 above.

13. Black River Rainbow Trout-Sea Lamprey Research

In conjunction with operation of Black River barrier to block spawning run of sea lampreys, its effectiveness as a barrier to the rainbow run is studied. A management program for the rainbow trout through age and growth studies, observations on the extent of spawning above the barrier, and creel census is developed.

Backinac County; began 1946, continuing; \$4,555; Thomas M. Stauffer, Leader; reports available.

Address inquiries to: As in No. 3 above.

14. Lower Gamble Creek Weirs

By tagging studies the migration pattern of brown trout and other species from Devoe Lake and Rifle River through Gamble Creek and diversion is learned. Species composition, numerical abundance, and age and growth of fishes caught in the weirs over a period of years are also followed.

Ogemaw County; began 1952, continuing; \$380; Howard Gowing, Leader; reports available.

Address inquiries to: As in No. 3 above.

15. Smallmouth Bass in the Great Lakes Waters of Michigan

By intensive investigation through study of ecology, exploitation, and distribution proper conservation and management for the smallmouth bass is determined.

Waugoshance Point, Emmet County, and other areas; began 1953, continuing; \$3,036; William C. Latta, reports available.

Address inquiries to: As in No. 3 above.

16. Life History - Coaster Brook Trout

The objective is to investigate growth, abundance, ecology, exploitation, and conservation of lake-run brook trout from streams tributary to Lake Superior.

Marquette and Alger Counties; began 1954, continuing; \$759; Merle G. Galbraith, Jr., Leader.

Address inquiries to: As in No. 3 above.

17. Life History and Management of Muskellunge

The objectives are to study such life history aspects as age and growth, spawning habits and requirements; obtain creel census information on lakes where muskellunge are native; and to evaluate results of stocking for maintenance.

Lake St. Clair and other waters; began 1951, continuing; \$1,518; John E. Williams, Leader; reports available.

Address inquiries to: As in No. 3 above.

18. Life History, Sea Lamprey

The objective is to determine the duration of the larval life of sea lampreys, and whether there is a resident population of sea lampreys in Carp Lake. By

preventing adults from reaching their spawning grounds and trapping downstream migrating recently transformed individuals the duration of larval life is to be determined. The problem of a resident population in Carp Lake is to be resolved by the installation of a weir at the outlet of Carp Lake.

Emmet County; began 1948, to close 1957; \$10,248; Vernon C. Applegate and Thomas M. Stauffer, Leaders; reports available.

Address inquiries to: As in No. 3 above.

19. Manistee River Watershed

This is an operational land use program designed to improve fishing conditions by the installation of practices and devices on both the uplands and the stream channels of the watershed. Work includes stream improvement structures (deflectors, covers, dams, etc.), bank stabilization, and stream side tree planting to provide shade. The upland work consists of tree planting and the stabilization of one large gully.

Crawford and Otsego Counties; began October 1954, continuing; \$24,700; Wayne H. Tody, Leader; reports available.

Address inquiries to: Wayne H. Tody, as in No. 1 above.

20. Watershed Surveys and Management Plans

The project will feature compilation of technical information on all watersheds of the State and provide plans for development of improved fishing conditions within them. Work will involve the assembly of available information, the classification of watershed areas, establishing detailed priority for work, and developing necessary maps and plans for the management to follow.

Statewide; began October 1952, continuing; \$40,000; Wayne H. Tody, Leader; reports available.

Address inquiries to: Wayne H. Tody, as in No. 1 above.

21. Importance of Bottom Organisms as Trout Food With Special Emphasis on the Fresh Water Midge (Tendipedidae, Diptera)

Square foot bottom samples and 25 sublegal trout were removed from three streams in Michigan during a 13-month period. The bottom samples are sorted, the volumes of the fauna determined, then statistically treated.

The objectives are: (1) To determine the importance of the midge fauna in the diet of trout, (2) the importance of other aquatic insects, and (3) the relationship of No's. 1 and 2 with respect to the seasonal distribution of the square foot bottom samples.

Central Michigan College, cooperating; headquarters - Central Michigan College; began July 1953, to close 1957; \$3,500; LaVerne L. Curry, Leader; reports available.

Address inquiries to: LaVerne L. Curry, Box 55, Central Michigan College, Mount Pleasant, Michigan.

22. Lake Sturgeon - Creel Census and Biology

The objectives are to determine harvest during winter spearing season; collect fin-rays for age determinations; and to compile information on length, weight, sex ratio, and maturity.

Burt, Mullett, and Black Lakes; began 1956, to close 1958; \$380; Henry J. Vondett, Leader; reports available.

Address inquiries to: As in No. 3 above.

23. Stream Bottom Fauna, Rifle River Improvement Project.

The objective is to determine abundance and composition of bottom fauna in Houghton Creek and other tributaries of Rifle River over a period of years

by quantitative and qualitative sampling. The importance of bottom fauna on trout production is part of the study.

Ogemaw County; began 1950, continuing; \$5,314; Robert J. Ellis, Leader; reports available.

Address inquiries to: As in No. 3 above.

24. Availability of Fish Food Organisms in Selected Southern Michigan Lakes

Year around quantitative and qualitative samples of fish food organisms are taken from selected warm water lakes in Michigan to determine the factors which influence the availability and utilization of fish food organisms. Also, limnological studies on plankton, nitrogen and phosphorus, and chemical characteristics of bottom soils are made.

Seven lakes in southern Michigan; began 1952, continuing; \$5,314; Frank F. Hooper, Leader; reports available.

Address inquiries to: As in No. 3 above.

25. Trout Food Studies With Special Emphasis on the Percentage of Midge Larvae in Food.

Samples are taken at monthly intervals. Stomach samples are obtained from angler-caught and shocker-caught fish and bottom samples are collected from areas where shocking is done.

Hunt Creek, Pigeon River, AuSable River; began 1953, continuing; \$1,139; LaVerne L. Curry, Leader.

Address inquiries to: As in No. 3 above.

26. Relation of Limnological Conditions to Periodicity of Growth and Change of Condition, Brook Trout in Lakes

The objectives are to determine the relationship of plankton and bottom fauna abundance and chemical conditions to growth of fish; and to furnish basic data to be used in determining rate and time of stocking and regulations.

Trout lakes in Pigeon River Research Area; began 1957, to close 1959; \$2,657; Thomas F. Waters, Leader.

Address inquiries to: As in No. 3 above.

27. Parasites and Diseases of Fish

Macro- and microscopic examination is made of sick fish in hatcheries with recommendations for treatment. Study and identification of fish parasites and diseases is conducted on a statewide basis.

Statewide; began 1942, continuing; \$2,657; Leonard N. Allison, Leader; reports available.

Address inquiries to: As in No. 3 above.

28. Check List of Fish Parasites in Michigan

Preparation and maintenance of a host parasite distribution list of parasites found in fish from Michigan waters is under way.

Statewide; began 1942, continuing; \$3,416; Leonard N. Allison, Leader; reports available.

Address inquiries to: As in No. 3 above.

29. Occurrence of Furunculosis in Rainbow Trout From the Great Lakes

The incidence and origin of furunculosis is being investigated in "wild" lake-run rainbows, specifically from Lake Huron into the East Branch of the Au Gres River where disease was first reported. Histological examination of preserved kidneys and cultures of fresh material is made when available.

Streams which support rainbow runs from Great Lakes; began 1952, continuing; \$759; Leonard N. Allison, Leader.

Address inquiries to: As in No. 3 above.

30. Kidney Disease in Trout in Michigan

The objective is to investigate the possibility of establishment of disease in trout in streams and lakes by stocking (accidentally) diseased fish. Control in hatcheries by drugs or by rearing of disease resistant trout is being attempted.

Statewide; began 1956, to close 1957; \$1,139; Leonard N. Allison, Leader.

Address inquiries to: As in No. 3 above.

31. Ecological Study of Red Cedar River

The objective is to determine ecological effects of industrial and domestic pollution, flood waters, low stream flow, and wide latitude of temperature on the vertebrate and invertebrate animal population of the stream. A complete physical and chemical analysis of water above and below sources of pollution is made. Animal populations will also be sampled.

Began 1955, to close 1957; \$2,657; Morris L. Brehmer, Leader.

Address inquiries to: As in No. 3 above.

32. Studies on the Use of Toxaphene in Fish Eradication

Tests of toxicity to fish and invertebrates will be made in laboratory and in natural waters. Duration of toxicity will also be determined.

Selected lakes; began 1954, closed 1956; \$2,277; Frank F. Hooper, Leader; reports available.

Address inquiries to: As in No. 3 above.

33. Bioassay of Chemicals Used in Public Waters

Laboratory tests are made for toxicity level of chemicals to fish and fish food organisms. Field tests of weed killers, algacides, and fish poisons are carried on.

Hillsdale Hatchery; began 1954, continuing; \$2,277; Frank F. Hooper, Leader; reports available.

Address inquiries to: As in No. 3 above.

34. Use of Underwater Swimming Equipment in Fisheries Investigations

The objective is to determine practicability of self-contained breathing apparatus in underwater photography, fish collecting, ecological observations, and other studies.

Selected lakes; began 1954, to close 1958; \$6,832; M. G. Galbraith, Jr., Leader; reports available.

Address inquiries to: As in No. 3 above.

35. Predator-Prey Relations of Warm-Water Fishes

By observation and sampling food preferences and feeding habits of northern pike, muskellunge, walleye, largemouth bass, gar, and dogfish are determined. The value of predator fishes in maintaining population balance in lakes is being investigated.

Hastings Fisheries Research Station; began 1956, continuing; \$9,109; John E. Williams, Leader.

Address inquiries to: As in No. 3 above.

36. General Creel Census

This project consists of a random creel census by conservation officers.

Statewide; began 1927, continuing; \$4,175, K. G. Fukano, Leader; reports available.

Address inquiries to: As in No. 3 above.

MICHIGAN (Cont. )

37. Census, Rifle River Area

From records of all angling, angling pressure is determined and trends in angling quality for the whole area are noted.

Rifle River Fisheries Research Area; began 1945, continuing; \$11,387; Mercer H. Patriarche, Leader; reports available.

Address inquiries to: As in No. 3 above.

38. Creel Census, Hunt Creek

By securing records of all fishing on the experimental area, trends in angling pressure and success are followed. Creel census results are used to evaluate the experimental program.

Hunt Creek Fisheries Research Area; began 1939, continuing; \$9,109; David S. Shetter, Leader; reports available.

Address inquiries to: As in No. 3 above.

39. Hillsdale Ponds Fishing Experiment

A complete angling record is secured under a permit system enabling study of the rate of removal by angling from a known fish population.

Hillsdale Hatchery; began 1946, continuing; \$2,657; K. G. Fukano, Leader; reports available.

Address inquiries to: As in No. 3 above.

40. Creel Census, Pigeon River Area

The project, aided by a permit system secures a complete record of fishing on 4.8 miles of the Pigeon River and from trout lakes on the area.

Pigeon River Fisheries Research Area; began 1950, continuing; \$5,693; Thomas F. Waters, Leader; reports available.

Address inquiries to: As in No. 3 above.

41. Population Studies, Hunt Creek

The objective is to determine residual populations through the use of various estimation techniques in waters of Hunt Creek drainage at the close of the angling season.

Hunt Creek Fisheries Research Area; began 1949, continuing; \$2,277; David S. Shetter, Leader; reports available.

Address inquiries to: As in No. 3 above.

42. Fish Population Studies

Determination of the size of populations of legal-sized game fish is the basis for interpretation of creel census data, and effects of special regulations. Estimation techniques are evaluated by use of mark and recapture methods.

Selected lakes; began 1952, continuing; \$7,212; Gerald P. Cooper, Leader; reports available.

Address inquiries to: As in No. 3 above.

43. Trout Population - Rifle River

Through various techniques the population trends of trout in Upper Rifle River are followed as a method by evaluating effects of watershed improvement.

Rifle River; began 1950, continuing; \$5,693; Howard Gowing, Leader; reports available.

Address inquiries to: As in No. 3 above.

44. Sea Lamprey Survey

The purpose is to determine the distribution of sea lamprey ammocoetes for future control, to determine the degree of escapement of sea lampreys and

rainbow trout through present control structures and to ascertain other effects of control structures on fishes.

Upper Peninsula; began 1955, continuing; \$6,832; T. M. Stauffer, Leader.  
Address inquiries to: As in No. 3 above.

45. Effect of Stream Improvement on Density of Trout Population

The objective is to determine effects and merits of stream improvement devices on population density and yield of trout in Pigeon River. Results before and after installation of structures will be compared.

Otsego County; began 1953, indefinite; \$380; T. F. Waters, Leader.  
Address inquiries to: As in No. 3 above.

46. Pool Construction as a Tool in Trout Management.

Pools were dredged in Pigeon River. Population survey before and after pool construction will help to determine results of this experiment.

Otsego County; began 1953, to close 1957; \$380; T. F. Waters, Leader.  
Address inquiries to: As in No. 3 above.

47. Population Manipulation, Big Bear Lake

Through netting control abundance of white sucker. The effects of this modification of population structure will be followed by mark-and-recapture estimates.

Otsego County; began 1940, continuing; \$380; Walter R. Crowe, Leader; reports available.

Address inquiries to: As in No. 3 above.

48. Fish Population Control by Partial Kill

The objective is to determine effects of reduction in numbers of pan fish by poisoning. Growth rates, yields, and changes in population structure are examined.

Fifteen lakes; began 1949, to close, 1961; \$10,628; J. E. Williams, Leader; reports available.

Address inquiries to: As in No. 3 above.

49. Relative Survival of Brown Trout and Rainbow Trout Planted in Spring or Fall

The objective is to determine results by planting equal numbers of each species in spring and fall. Results are based on creel census data and population surveys.

Four trout streams; began 1951, continuing; \$11,387; D. S. Shetter, Leader; reports available.

Address inquiries to: As in No. 3 above.

50. Relative Survival of Wild Versus Hatchery-reared Fingerling Trout

Equal numbers of fingerlings are marked and the results are determined by creel census and population surveys.

Pigeon River; began 1951, closed 1956; \$1,518; T. F. Waters, Leader; reports available.

Address inquiries to: As in No. 3 above.

51. Walleye Sport Fishery Management

Introductions of walleye fingerlings are made in selected lakes on an introductory or maintenance basis. Results followed by random creel census and netting.

Forty-three lakes; began 1951, continuing; \$380; Walter R. Crowe, Leader; reports available.

Address inquiries to: As in No. 3 above.

MICHIGAN (Cont.)

52. Experimental Planting of Fingerling Brown Trout in Rifle River  
The project will determine survival of marked fingerling brown trout through complete creel census and also by periodic population checks.  
Ogemaw County; began 1952, to close 1958; \$380; H. Gowing, Leader.  
Address inquiries to: As in No. 3 above.
53. Sub-legal Trout Plantings in Streams in Spring  
The objective is to determine if 4½- to 6½-inch brook trout and rainbow trout released in April, will contribute to anglers catch during same or succeeding seasons. Results are followed through a complete creel census.  
Trout research stations; began 1953, closed 1956; \$380; D. S. Shetter, Leader.  
Address inquiries to: As in No. 3 above.
54. Introduction of Redear Sunfish  
The objective is to determine, through introduction into a variety of situations, if the species has an important sport fishing potential in Michigan. Results are determined by periodic netting and a random creel census.  
Five lakes; began 1954, to close 1958; \$380; Walter R. Crowe, Leader.  
Address inquiries to: As in No. 3 above.
55. Great Lakes "Steelhead"  
The objective is to determine if hatchery-reared rainbow trout can be used to supplement natural runs of steelhead from Great Lakes. Tagged rainbow trout are planted in mouths of streams tributary to Great Lakes, the results followed by analysis of tag returns.  
Streams tributary to Great Lakes; began 1954, to close 1960; \$4,555; T. M. Stauffer, Leader; reports available.  
Address inquiries to: As in No. 3 above.
56. Carp Control  
The objective is to devise methods and test results of controlling carp abundance in selected lakes.  
Southern Michigan; began 1956, indefinite; \$1,518; J. E. Williams, Leader.  
Address inquiries to: As in No. 3 above.
57. Population Control - North Lake  
Northern pike in North Lake are controlled by trapping them on their spawning migration. The lake is managed for trout.  
Ogemaw County; began 1955, indefinite; \$380; H. Gowing, Leader.  
Address inquiries to: As in No. 3 above.
58. Results From Planting Brook Trout Fry in Trout Lake  
Results of the stocking is determined by examination of growth, yield, and creel census data.  
Otsego County; began 1956, to close 1957; \$1,139; Thomas F. Waters, Leader.  
Address inquiries to: As in No. 3 above.
59. Lake and Pond Fertilization  
The project aims to determine the practical value of commercial fertilizer as a tool in warm water fish production by experiments in selected lakes, and in hatchery ponds.  
Began 1946, continuing; \$4,555; Robert C. Ball, Leader; reports available.  
Address inquiries to: As in No. 3 above.

60. Increasing Productivity of Marl Lakes

Additions of organic matter and inorganic fertilizers are made to marl soils to determine the factors limiting the production of fish food organisms in marl lakes. Methods of modifying marl lakes so as to increase their productivity are being investigated.

Began 1952, continuing; \$2,657; Frank F. Hooper, Leader; reports available.

Address inquiries to: As in No. 3 above.

61. Bottom Fauna and Condition of Brown Trout in Houghton Creek

The objective is to determine the effects of the Rose City sewer upon bottom fauna and brown trout in Houghton Creek.

Ogemaw County; began 1953, closed 1956; \$759; Howard Gowing and Robert J. Ellis, Leaders; reports available.

Address inquiries to: As in No. 3 above.

62. Headwater Lake Fertilization

The objective is to determine the effect of fertilizing a headwater lake upon the stream below.

Hoffman Lake and West Branch of Sturgeon River; began 1954, to close 1957; \$4,555; Frank F. Hooper and Robert C. Ball, Leaders.

Address inquiries to: As in No. 3 above.

63. Weed Control in Fisheries Management

The objective is to determine effect of control of aquatic vegetation on growth of pan fishes in selected lakes.

Began 1955, to close 1959; \$9,109; Frank F. Hooper and J. E. Williams, Leaders.

Address inquiries to: As in No. 3 above.

64. Establishment of Rooted Vegetation in Marl Lakes

Through plantings of seeds and tubers attempts will be made to establish rooted vegetation in marl lakes and effects of the experiment on fish population will be followed.

Fish Lake and Devoe Lake; began 1955, continuing; \$4,555; Frank F. Hooper, Leader.

Address inquiries to: As in No. 3 above.

65. Improvement of Pike Spawning Habitat

The purpose of the project is to discover requirements of pike for spawning and to devise and analyze methods by which spawning success may be improved.

Selected lakes; began 1950, to close 1960; \$1,139; John E. Williams, Leader.

Address inquiries to: As in No. 3 above.

66. Experimental Fishing Regulations on Lakes

Creel census, age, growth, and population studies are being used to determine the effect of relaxed fishing regulations on 14 "experimental" lakes.

Began 1953, to close 1960; \$35,299; Kenneth E. Christensen, Leader; reports available.

Address inquiries to: As in No. 3 above.

67. Hooking Mortalities - Trout

The objective is to determine mortality to undersized trout through the use of plugs, spoons, spinners, and other baits. Fish, both hatchery reared

and wild will be caught by all methods, released and held in live crates or raceways and observed for instantaneous or delayed mortality.

Trout streams and hatchery ponds; began 1955, to close 1957; \$1,139; David S. Shetter and Leonard N. Allison, Leaders; reports available.

Address inquiries to: As in No. 3 above.

68. Autopsy of Trout Following Hooking Loss Experiments

Fish which have died following hooking experiments are examined for hook wounds and an effort is made to determine whether death resulted from mechanical injury or disease.

Trout streams and hatchery ponds; began 1955, to close 1957; \$759; Leonard N. Allison, Leader.

Address inquiries to: As in No. 3 above.

69. Brook Trout and Brown Trout Fishing Regulations

The project is designed to test the effect of higher size limits and bait restrictions on angling quality for brook trout and brown trout.

Trout streams; began 1949, continuing; \$18,218; David S. Shetter, Leader; reports available.

Address inquiries to: As in No. 3 above.

70. Winter Fishing for Rainbow Trout

The objective is to determine whether a winter season, January 1 through March 15, will increase the harvest of maintenance plantings of rainbow trout without seriously effecting spring, summer, or fall fishing for them. The project will also determine the reason for decline of returns from plantings after a few years of good fishing.

Correy Lake; began 1957, to close 1961; \$2,277; Walter R. Crowe, Leader.

Address inquiries to: As in No. 3 above.

71. Effect of Hooking Mortality Upon the Angler's Catch

Equal numbers of sub-legal trout are caught with worms, flies, and shocker. They are marked with a distinctive fin clip to compare survival to creel of different groups.

Pigeon River; began 1956, to close 1958; \$380; T. F. Waters, Leader.

Address inquiries to: As in No. 3 above.

72. Effect of Fly-fishing-only Regulations will increase the survival to legal size and the size of trout in the angler's catch. Flies only are used in Ford Lake, whereas usual bait restrictions are followed at Hemlock Lake.

Trout lakes on Pigeon River Fisheries Research Area; began 1956, to close 1958; \$759; T. F. Waters, Leader.

Address inquiries to: As in No. 3 above.

73. Birch Lake Fish Management

The project is designed to determine the value and effects of planting trout and smallmouth bass, the effect of ciscoe gill netting, the need for a screen in the outlet, and the effect of May 15 opening date. A creel census, marked plantings, and a two-way weir in the outlet are involved.

Cass County; began 1937, continuing; \$2,657; R. N. Schafer, Leader; reports available.

Address inquiries to: As in No. 3 above.

74. Deep Lake Fish Management

Periodic fish collections are made to study survival and growth of species planted since the lake was poisoned in 1941. The present population is composed of bluegills, redear sunfish, largemouth bass, and rainbow trout.

Oakland County; began 1952, continuing; \$380; Walter R. Crowe, Leader; reports available.

Address inquiries to: As in No. 3 above.

75. Management of Special Trout Pond

Various stocking programs are tested by complete creel census and counts of residual populations after draining.

Ponds at Hillsdale Hatchery; began 1946, continuing; \$2,657; K. G. Fukano, Leader; reports available.

Address inquiries to: As in No. 3 above.

76. Experimental Management of Brook Trout Lakes in Upper Peninsula

The objective is to determine proper management of lakes stocked with brook trout. Results will be determined through creel census. Various stocking programs, size limits, and regulations will be tested.

Trout lakes in Upper Peninsula; began 1953, to close 1961; \$21,255; M. G. Galbraith, Jr., Leader; reports available.

Address inquiries to: As in No. 3 above.

77. Development of Rotary Screens

The purpose of the project is to design a simpler and lighter self-cleaning rotary screen to replace those now in use.

Hunt Creek Fisheries Research Area; began 1956, closed 1956; \$380; M. J. Whalls, Leader; reports available.

Address inquiries to: As in No. 3 above.

78. Hatchery Diets

The objective is to determine the value of various diets through controlled experiments. Results are tested in production hatcheries.

Trout hatcheries; began 1952, continuing; \$380; Leonard N. Allison, Leader; reports available.

Address inquiries to: As in No. 3 above.

79. Transportation of Trout

The objective is to test plastic bags containing water and oxygen as a method of transporting more trout in less space.

Grayling pathology laboratory; began 1956, closed 1956; \$380; Leonard N. Allison, Leader.

Address inquiries to: As in No. 3 above.

80. Library of Colored Illustrations of Fish Diseases and Hatchery Procedures

Through the use of kodachrome photographs illustrations of fish diseases (macro and micro) and hatchery procedures are provided for reference and instruction.

Grayling pathology laboratory; began 1953, continuing; \$380; Leonard N. Allison, Leader; photographs available.

Address inquiries to: As in No. 3 above.

81. Fishes of Michigan

A comprehensive reference book on fishes of the State on their structure, habits, distribution, abundance, etc. with illustrations and keys for general

use of sportsmen, biologists, and students is under preparation.

University Museums Annex, Ann Arbor, and Museum of Zoology, University of Michigan; began 1946, continuing: \$1,155; Gerald P. Cooper and Reeve M. Bailey, Leaders.

Address inquiries to: As in No. 3 above.

82. Manual for Control of Fish Diseases at Hatcheries

From literature and experience, a manual, including conversion tables, dilution charts, etc. will be provided for the use of fish culturists.

Grayling pathology laboratory; began 1953, closed 1956; \$1,898; Leonard N. Allison, Leader.

Address inquiries to: As in No. 3 above.

83. Lake Inventory Reports

Research findings on some of the larger lakes of the State are briefly explained and the purpose and methods of inventory made available for public distribution.

Began 1952, continuing; \$380; Clarence M. Taube, Leader; reports available.

Address inquiries to: As in No. 3 above.

University of Michigan

1. Fishes of the Great Lakes Region

The objective is to provide up-to-date knowledge on classification and distribution of the components of the fauna and to extend the utility of the work for identifying the fishes of the region.

Cranbrook Institute of Science cooperating; Ann Arbor; began June 1953, to close September 1959; Karl F. Lagler and Carl L. Hubbs, Leaders.

Address inquiries to: Karl F. Lagler, Department of Fisheries, Natural Science Building, Ann Arbor, Michigan.

2. Revision of "Freshwater Fishery Biology"

The objective is to improve and extend the usefulness of existing works.

Ann Arbor; began September 1952, to close January 1957; Karl F. Lagler, Leader.

Address inquiries to: As in No. 1 above.

3. Textbook of Ichthyology

The objective is to provide for American workers a text dealing with world principles of ichthyology, but emphasizing the use of examples and illustrations from the American fauna.

Ann Arbor; began September 1955, to close September 1958; K. F. Lagler, Leader.

Address inquiries to: As in No. 1 above.

4. Evaluation of Fishery Survey Techniques Using SCUBA

The objective is to determine efficiency of survey techniques, such as netting for determining fish species composition, by making comparisons and observations using SCUBA (diving equipment).

Institute for Fisheries Research cooperating; began June 1955, to close May 1957; Donald Thomson, Leader.

Address inquiries to: Donald Thomson, Department of Fisheries, Natural Science Building, University of Michigan, Ann Arbor, Michigan.

5. The Degree of Correlation Between the Material in Stomach Samples, in Cutthroat and Rainbow Trout, and the Lure Upon Which the Fish Were Taken  
This project is an attempt to test the correlation between the lure, as to size, shape, color, and method of fishing, and the animal life contained in stomach samples, as to size, shape, color, and habits, in cutthroat and rainbow trout. The material was gathered in the Cooke City area in Montana at the northeast entrance of Yellowstone National Park.  
Park County, Montana; began June 1956, to close June 1957; Kenneth Cummins, Leader.  
Address inquiries to: Kenneth Cummins, Department of Fisheries, University of Michigan, Ann Arbor, Michigan.
6. The Age and Food Habits of the Smelt, (*Osmerus mordax*)  
The objective is to evaluate the age and food habits of the smelt in Saginaw Bay during the months June, July, August, and September 1956.  
U. S. Fish and Wildlife Service cooperating; began June 1956, to close May 1957; William G. Gordon, Leader.  
Address inquiries to: William G. Gordon, Department of Fisheries, School of Natural Resources, University of Michigan, Ann Arbor, Michigan.
7. Validity of Age Determination from Scales, and Growth of Marked Lake Michigan Lake Trout  
The objectives are to ascertain whether any repetitive markings on the scales of lake trout could be linked with the known age of fin-clipped fish, to establish the time of annulus formation, and to follow the development of marginal growth on the scales. Growth of the fish was also studied.  
Conservation Departments of Michigan and Wisconsin cooperating; Ann Arbor; began July 1951, closed November 1956; Louella E. Cable, Leader; reports available.  
Address inquiries to: Louella E. Cable, 1220 East Washington St., Ann Arbor, Michigan.
8. The Temperature Sensitivity of Some American Freshwater Fish  
The objectives are to test the acuity of perception of fish to temperature changes, and to make a preliminary determination of the mechanism by which fish sense small temperature changes.  
Horace H. Rackham School of Graduate Studies cooperating; University of Michigan; began January 1955, closed June 1956; reports available.  
Address inquiries to: John E. Bardach or Richard G. Bjorklund, Department of Fisheries, School of Natural Resources, University of Michigan, Ann Arbor, Michigan.
9. The Effect of Light, Thyroid and Antithyroid Substances on Normal Growth, Regeneration of Fins and Scales, and Gonad Maturation in the Goldfish  
The objectives are: (1) To evaluate the role of the photoperiod in growth and maturation of fish, and (2) to determine the effect of thyroid and antithyroid substances on maturation, growth, and metabolism of fish with a view to determining thyroid function in teleosts.  
Horace H. Rackham School of Graduate Studies cooperating; University of Michigan; began July 1955, to close June 1957; R. G. Bjorklund, Leader.  
Address inquiries to: R. G. Bjorklund, as in No. 8 above.
10. Biology of Chubs of Lake Michigan  
The objectives are to learn basic facts of life history and distribution and to relate these to rise of sea lamprey population.  
U. S. Fish and Wildlife Service cooperating; Ann Arbor, Michigan; began

January 1954, to close January 1957; Kenneth M. Allen, Leader.

Address inquiries to: U. S. Fish and Wildlife Service, Box 640, Ann Arbor, Michigan.

11. Lake Distribution of Largemouth Bass

The objectives are to learn the facts and factors of lacustrine distribution and movements of largemouth bass by netting, angling, tower observation, and SCUBA.

Began July 1955, to close July 1957; R. Jack Schultz, Leader.

Address inquiries to: R. J. Schultz, Department of Fisheries, Natural Science Building, University of Michigan, Ann Arbor, Michigan.

12. The Fishes of Isle Royale National Park

The objective is to provide the public with a guide to the fish and fishing of Isle Royale National Park.

Began 1955, closed November 1956; Karl F. Lagler and Charles R. Goldman, Leader.

Address inquiries to: Karl F. Lagler, as in No. 1 above.

13. Food Habits of the Leucichthys spp. and its Relation to the Ecology of Lake Michigan

Analysis of the food habits data of the Leucichthys may enable us to define its position as an existing population in relation to the other animal populations in that particular ecological unit. It may partly or wholly influence fluctuations among the other organisms or some of their peculiar behavioural characteristics.

Other objectives are to determine the bathymetric distribution of the chub in relation to the vertical distribution of Mysis and Pontoporeia as well as population levels and rates of growth of the fish under investigation.

The project provides a basis for determination of the degree of predation and competition in that particular ecological community and may be used as important bases for resource management of the chub, the most important commercial fish in Lake Michigan.

U. S. Fish and Wildlife Service cooperating; began June 1956, to close 1957; Silvestre V. Bersamin, Leader.

Address inquiries to: Silvestre Bersamin, Fisheries Department, University of Michigan, Ann Arbor, Michigan.

14. Life History and Management of Arctic Grayling in Grebe Lake, Yellowstone Park, Montana.

A general biological investigation.

U. S. Fish and Wildlife Service cooperating; Yellowstone Park; began August 1956; T. E. Kruse, Leader.

Address inquiries to: Department of Fisheries, University of Michigan, Ann Arbor, Michigan.

15. Effects of Sub-lethal Levels of Pollution on the Fish and Fish-food Organisms of Warm-water Streams

This project is an evaluation of effects of domestic and industrial pollution on biota of the stream. Conditions range from polysaprobic to oligosaprobic and effects on aquatic organisms of varying types and intensities of pollutants are being evaluated.

Ingham County; began 1954, to close 1958; R. C. Ball, Leader.

Address inquiries to: R. C. Ball, Department of Fisheries and Wildlife, University of Michigan, East Lansing, Michigan.

16. Fertilization of a Marl Lake and a Trout Stream of Low Productivity

The above two projects have a common goal and are being carried out together. Fertilizer applied to the marl lake becomes, in part, organic nutrients. The incorporation of these nutrients into the biota of the stream is being studied.

Otsego County; began 1954, to close 1957; R. C. Ball and F. F. Hooper, Leaders.

Address inquiries to: R. C. Ball, as in No. 15 above.

17. Effects of Fish Predation on Production of Fish-food Organisms

An investigation of the relationships between standing crops of fish and total fish populations. Approach is through a study of the dynamics of the food-organism complex and the influence of predation by the fish population.

Lake City Experiment Station Ponds; began May 1956, continuing; Robert C. Ball and D. W. Hayne, Leaders.

Address inquiries to: R. C. Ball, as in No. 15 above.

18. Primary Production in a Warm-water Stream

A study of the rate of synthesis of organic matter in a warm-water stream, including production rates under high nutrient conditions, as well as those of low nutrient analysis.

Ingham County; began 1955, to close 1958; Robert C. Ball, Leader.

Address inquiries to: R. C. Ball, as in No. 15, above.

19. Biological Effects of a Concentration of Waterfowl on a Warm-water Lake

A quantitative chemical evaluation of certain nutrients contributed seasonally to the lake and their biological effects within the lake.

Wintergreen Lake, Kellogg Bird Sanctuary, Hickory Corners, Michigan; began 1955, continuing; R. D. VanDeusen, Leader.

Address inquiries to: R. C. Ball as in No. 15 above.

20. Fishery Management Evaluation

The objectives are: (1) To evaluate various stocking procedures in terms of returns to the angler, and (2) to evaluate angler ability to catch fish and the degree and nature of the variation in angling success.

East Lansing and Augusta; began July 1932, continuing; \$250; Peter S. Tach, Leader; reports available.

Address inquiries to: P. S. Tach, Department of Fisheries and Wildlife, University of Michigan, East Lansing, Michigan.

21. Ecology of Commercial Fish Species in Northern Lake Michigan

The primary purpose of this project is to determine and evaluate the factors involved in the success or failure of successive year-classes of some important commercial fish species. Most of the work to date has been a study of the growth and age-composition of the whitefish. Long-range plans include studies of other species, with more emphasis on young-of-the-year fish.

Big Bay de Noc and northern Lake Michigan; began July 1955; \$3000; Eugene W. Roelofs, Leader.

Address inquiries to: E. W. Roelofs, Department of Fisheries and Wildlife, University of Michigan, East Lansing, Michigan.

Central Michigan College

1. Ecology and Taxonomy of Midge Larvae

Field collections of midge larvae, rearing of same in laboratory for

(1) association of immature forms with adults, (2) study of food habits and life cycle of specific species, and (3) the role of the midge larvae in the turn over of bottom muds especially as related to radio active substances.

U. S. Atomic Energy Commission cooperating; Central Michigan College, began April 1955, indefinite; LaVerne L. Curry, Leader.

Address inquiries to: LaVerne L. Curry, Box 55 Central Michigan College, Mount Pleasant, Michigan.

U. S. Fish and Wildlife Service, Branch of Fishery Biology

1. Fluctuations, Interrelationships, and Movements of Fish Populations

The objective of this project is to follow the fluctuations in the age, growth, size, and abundance of the different species, commercial and non-commercial; and to ascertain through marking experiments and morphological studies whether local races and stocks exist, and the extent of movements and intermingling of different segments of the populations.

Wisconsin Conservation Department and the Michigan Department of Conservation cooperating; Ann Arbor, Michigan, headquarters, Lakes Michigan and Superior; began 1947, continuing; \$18,000; Leonard S. Joeris, Leader; reports available.

Address inquiries to: James W. Moffett, Chief, Great Lakes Fishery Investigations, P. O. Box 640, Ann Arbor, Michigan.

2. Survey of Great Lakes Tributary Streams

The objectives are to determine the location of all streams in the Superior, Michigan, and Huron basins in which successful reproduction of the sea lamprey can occur, and to determine the degree to which such streams are or may be utilized by the species, to determine therefrom where control structures must be located.

Marquette and Ludington, Michigan; began May 1950, continuing; \$25,000; Alberton L. McLain, William E. Gaylord, and Robert A. Bream, Leaders; reports available.

Address inquiries to: James W. Moffett, as in No. 1 above.

3. The Growth, Abundance and Habits of Yellow Perch in Saginaw Bay, Lake Huron

The objectives are to learn changes in the perch population between the time of an earlier 1929-1930 study and 1943-1955; and to study the extent and factors of fluctuations in growth and year class strength.

Saginaw Bay and Ann Arbor; began 1954, to close 1957; \$7,000; Salah El-Zarka, Leader.

Address inquiries to: James W. Moffett, as in No. 1 above.

4. Development of Fish "Leading" or "Assembling" Devices

The objective is to develop a device utilizing some form of pulsed direct current which may be used as an accessory to the electro-mechanical weir and trap to aid in the rapid transfer upstream of food and game fishes migrating with the sea lampreys.

Marquette, Michigan (Lake Superior streams); began 1951, continuing; \$9,000; Alberton L. McLain, Leader; reports available.

Address inquiries to: James W. Moffett, as in No. 1 above.

5. Chemical Control Techniques

The objectives are to determine whether a specific toxicant exists which will be lethal to larval lampreys but harmless to other aquatic life occupying the

same environment and to determine whether this toxicant can be applied in streams in an efficient and economical manner.

Hammond Bay Fishery Laboratory, Rogers City; began June 1950, continuing; \$70,000; Vernon C. Applegate, Leader.

Address inquiries to: James W. Moffett, as in No. 1 above.

6. Experimental Control of Sea Lamprey Spawning Populations in Streams Tributary to Lakes Superior and Michigan

The objectives are to install electrical or physical barriers in streams known to be utilized by sea lamprey for spawning and to operate these structures in a manner sufficient to reduce or eliminate reproduction and ultimately predation on lake trout and other fishes, and to determine the effects of barriers on species of fish migrating into streams at the same time as the sea lamprey.

Michigan Department of Conservation, Wisconsin Conservation Department and Canadian agencies cooperating; U. S. shores of Lakes Superior and Michigan; began April 1953, continuing; \$163,000; Leo F. Erkkila and Bernard R. Smith, Leaders; reports available.

Address inquiries to: James W. Moffett, as in No. 1 above.

7. Testing the Effects of Planting Methods, Times of Planting and Influence of Size at Planting on the Survival of Lake Trout in Lake Superior

It is hoped to develop efficient methods of producing and stocking of lake trout to be used in the rehabilitation of these fish in Lakes Michigan, Huron, and Superior after sea lamprey populations are under control. Lake trout held over various periods in hatcheries are marked. They are then stocked at different times and their survival determined from marked fish returned. Planting is done over areas where native lake trout of the same size range are found by exploratory fishing.

Michigan Department of Conservation, Wisconsin Conservation Department and Minnesota Department of Conservation cooperating; Marquette; began December 1951, continuing; Paul Eschmeyer and James W. Moffett, Leaders.

Address inquiries to: James W. Moffett, as in No. 1 above.

8. Life History Studies of Fishes of the Great Lakes

The objectives of this project are to obtain fundamental information on the life histories of commercially important species in such matters as identity of populations, movements, seasonal and local abundance, fluctuations in growth, and strength of year classes.

Ann Arbor; began May 1950, continuing; \$35,000; Ralph Hile, Leader; reports available.

Address inquiries to: James W. Moffett, as in No. 1 above.

9. Movements of Lake Trout in Lake Superior

Through the tagging of both legal-sized and under-sized lake trout in different regions of Lake Superior the extent of migrations with special reference to the possible presence of local races and movements across interstate and international boundaries will be determined.

Marquette; began June 1950, continuing; \$15,000; Joseph Beil, Leader; reports available.

Address inquiries to: James W. Moffett, as in No. 1 above.

10. Limnological and Fishery Survey of Saginaw Bay

This project is designed to develop information on the limnology and fisheries of Saginaw Bay and to relate these features to each other to determine their influences on abundance, growth, and fluctuations in available populations. Synoptic surveys of the major biological and hydrographic features

## MICHIGAN (Cont.)

of the entire Bay were made along with continuous observations in a portion of the Bay.

Michigan Department of Conservation cooperating; Lake Huron; began May 1956, continuing; \$50,000; Stanford H. Smith, Leader.

Address inquiries to: James W. Moffett, as in No. 1 above.

## MINNESOTA

### Department of Conservation

#### 1. Yield and Dynamics of a Small Inland Lake Trout Lake

This study is intended to provide information on dynamics of the fish population, yield to the fishery, and contribution of yearling stocking program to creel compared to natural reproduction on a typical inland lake trout lake. Information will be used in development of management plans for other lakes of this type.

Cook County; began January 1951, to close 1959; Robert E. Schumacher, Leader.

Address inquiries to: Robert E. Schumacher, 400 Shubert Building, St. Paul, Minnesota.

#### 2. Rough Fish Removal Study

This study is intended to determine the level at which rough fish populations must be cropped for effective reduction, and effect of practical levels of removal on game fish populations. An attempt will be made to relate trap net catches to size of rough fish populations and amount available for removal operations. Information on angling success before and after removal operations will be included.

LeSueur, Steele, and Waseca Counties; began January 1955, to close 1957; W. J. Scidmore, Leader.

Address inquiries to: W. J. Scidmore, 400 Shubert Building, St. Paul 2, Minnesota.

#### 3. Investigation of Techniques for the Improvement of Fish Food Culture Methods

The study will be conducted along four lines of approach all having to do with fertilization. The objectives are as follows: (1) To find the kinds and amount of certain food organisms that can be produced with various types of fertilizers and fertilization methods. (2) To determine the length of time necessary for each type of fertilizer to become effective. (3) To ascertain the amount of fertilizer that can be added to a body of water without causing conditions lethal to fish. (4) To evaluate the effect on pond conditions when grass or grain is grown on pond bottoms prior to flooding.

Waterville; began April 1957, to close 1967; John Dobie, Leader.

Address inquiries to: John Dobie, 400 Shubert Building, St. Paul 2, Minnesota.

#### 4. Aquatic Wildlife Surveys

Complete but concise lake, stream, and river surveys including sounding maps are prepared to give the game and fisheries managers information together with recommendations for management of game and fish species.

Statewide; began 1931, continuing; \$120,000; Henry Swanson, Leader; reports available.

Address inquiries to: Jerome H. Kuehn, Supervisor, Survey and Inventories Unit, 600 Shubert Building, St. Paul 2, Minnesota.

5. Study of Relative Efficiency and Selectivity of Cotton and Nylon Experimental Gillnets

The project has been undertaken to determine the relative effectiveness of cotton and nylon gill nets and to develop a factor whereby previously collected catch data from cotton gill nets may be expressed in terms of nylon gill net catches. The comparative selectivity of the two types of nets is determined.

Statewide; began June 1956, to close October 1957; W. J. Scidmore, Leader; reports available.

Address inquiries to: W. J. Scidmore, as in No. 2 above.

6. Statewide Creel Census

A quantitative as well as qualitative census is being carried out on 29 lakes and 4 trout streams to determine total yield in terms of numbers and pounds; relationship between fish population structure and size to yield; relative efficiency of fishing by different methods; and, to evaluate effects of fish management measures on yield. The stream census was designed to also check differential vulnerability of two important trout species.

Statewide; began December 1952, continuing; \$93,000; Merle Johnson, Leader; reports available.

Address inquiries to: Jerome H. Kuehn, as in No. 4 above.

7. Investigation of Year Class Formation in Game Fish

Studies are in progress to determine relative influence of physical, chemical, and biological factors which affect the natural reproduction success of northern pike and largemouth bass. Such work is intended as furnishing a means of assessment of year class strength in the earlier stages of life of more important game fish species.

University of Minnesota cooperating; George Lake; began April 1955; \$12,800; Lloyd L. Smith, Jr., Leader.

Address inquiries to: Lloyd L. Smith, Department of Entomology and Economic Zoology, University of Minnesota, St. Paul, Minnesota.

8. An Economic Evaluation of the Sport Fishery in Minnesota

This is a project which is designed to give an accurate and reliable estimate of the extent of the economic value of the sport fishery of Minnesota. The first phase of the project, which is a survey by mail of non-resident fishermen, is being carried out during the fall of 1956. The second phase is a survey by personal interview of Minnesota resident fishermen which will be carried out during the fall of 1957. Both phases of this project will be carried out on a scale large enough to give statistical reliability to within 10 percent.

Headquarters - St. Paul; began October 1956, to close November 1957; \$200; Zane Scheftel, Leader.

Address inquiries to: Zane Scheftel, Fisheries Research Unit, 400 Shubert Building, St. Paul 2, Minnesota.

9. Evaluation of Fish Management Operations

Investigations are in progress in several management programs to determine their effectiveness and value to the over-all management effort. These investigations are as follows: (1) Evaluation of artificial panfish removal as a means of improving growth rates and average size of individuals in stunted panfish lakes, (2) a study of the results of stocking with stunted panfish obtained from artificial population thinning operations, (3) evaluation of the use of refuge nursery streams as a stream trout management technique, and (4) a study of the effect of stream improvement practices on trout populations and fishing.

Statewide; C. R. Burrows, Leader.

Address inquiries to: C. R. Burrows, Supervisor, Fisheries Research Unit, 400 Shubert Building, St. Paul 2, Minnesota.

10. Improvement of Design of Electric Fishing Gear for Collecting Fish in Large Lakes and Rivers

An attempt will be made to design electrical apparatus capable of collecting young of the year game fish in shallow waters of lakes and adaptable for use in quantitative fish sampling in large rivers of both hard and soft water areas.

Statewide; began June 1956, to close October 1957; C. R. Burrows, Leader.  
Address inquiries to: C. R. Burrows, as in No. 9 above.

11. Design of New Techniques and Modification of Current Methods of Fish Cultural Practices as Related to Propagation of Fish and Diagnosis and Control of Fish Disease

The objectives are to develop new techniques in fish hatchery cultural procedures, disease diagnosis, and therapy and to test new techniques and institute new methods proven by investigative work in other areas. Current work includes many small projects such as pelleted trout food formulation, investigation of sanitation conditions in hatcheries, methods of disease transmittal, incubation period of diseases, effectiveness and degree of dispersal of medication in trout food and design of trout distribution units for higher survival.

Statewide; R. E. Schumacher, Leader.

Address inquiries to: R. E. Schumacher, as in No. 1 above.

12. Investigation of Possible Differences in Blood Physiology Between the Two Sexes of Ameiurus sp.

The objective is to get an almost complete blood picture of one species. Preliminary work only has been conducted primarily on the estimation of blood volume, sedimentation rates, coagulation time, and blood cell counts.

Gustavus Adolphus College; began September 1953, indefinite; \$25; Arthur W. Glass, Leader.

Address inquiries to: Arthur W. Glass, Gustavus Adolphus College, St. Peter, Minnesota.

University of Minnesota

1. The Taxonomic Status of the Fat Trout or Siscowet of Lake Superior

A study of the morphology and other characters of the fat trout to determine its relation to the lake trout.

Minnesota Department of Conservation cooperating; headquarters - University of Minnesota; began 1945, to close December 1957; Samuel Eddy and James C. Underhill, Leaders.

Address inquiries to: Samuel Eddy, Department of Zoology, University of Minnesota, Minneapolis 14, Minnesota.

2. Survey of the Fishes of the Red River (of the North) System

A study of the species and distribution of fishes in the Red River and in the Red River drainage.

Minnesota Department of Conservation cooperating; headquarters - University of Minnesota; began June 1955, to close June 1958; Samuel Eddy, Leader.

Address inquiries to: Samuel Eddy, Department of Zoology, University of Minnesota, Minneapolis, Minnesota.

## MISSISSIPPI

### Game and Fish Commission

#### 1. Fisheries Investigation on Flood Control Reservoirs

The objectives are to determine the existing fish populations, make life history studies of the fish found to be present and to determine their growth rates and food habits. Studies of the distribution and migration patterns will be undertaken. Creel census studies will be conducted and commercial catch data obtained. Chemical, physical, and other biological data not listed here will be obtained from time to time to determine their effects on the factors which are under investigation.

U. S. Army Engineers and University of Mississippi cooperating; Enid, Grenada, Arkabutla, and Sardis Reservoirs; began June 1955, to close June 1958; \$22,034; Bobby A. Towery, Leader.

Address inquiries to: Barry O. Freeman, Chief, Fisheries Division, State Game and Fish Commission, Box 451, Jackson, Mississippi.

#### 2. Coastal Stream Investigation

The objectives are: (1) To inventory and classify water areas of the coastal stream drainages; (2) to determine the season movements and abundance of the fresh water fish population in the project areas, and the success of natural reproduction and growth rate of these fishes, and (3) to utilize conclusive findings to devise sound biological techniques to better manage the game fish resources.

In the project area the stream drainage frons a mass of bayous, ox-bows, estuaries, and channels in the State's lower coastal terrace. In addition to the fresh water area, the Game and Fish Commission has jurisdiction over several large bays along the coast. Due to their location, these waters and, in consequence, the sport fish populations are affected by tidal action from the Gulf of Mexico.

West Pascagoula and Biloxi Rivers, Jordan, Wolf, Tchouticabouffa and East Pascagoula Rivers; began July 1954, to close June 1957; \$17,320; J. L. Nipper, Leader.

Address inquiries to: Barry O. Freeman, as in No. 1 above.

### Gulf Coast Research Laboratory

#### 1. A Study of the Ecology of Fishes of Mississippi Sound

The objective is to correlate and bring together an unassimilated mass of data on the fishes of Mississippi Sound, with the view of obtaining a coherent ecological picture.

Ocean Springs, Mississippi; began 1955, to close 1957; \$3,000; Ted Ford, Leader.

Address inquiries to: Wild Life and Fisheries Commission, Civil Courts Building, New Orleans 16, Louisiana.

## MISSOURI

### Conservation Commission

#### 1. August A. Busch Memorial Wildlife Area Lake Development

This area is managed jointly for public fishing and as a field trial area. On the area are 32 ponds and lakes with a combined area of 145 acres at normal water elevation. Two lakes having a total of 90 acres are being added. These waters are managed for largemouth bass, bluegill and channel catfish fishing.

MISSOURI (Cont. )

A nominal fee is charged for fishing privilege, boats and bait. Creel records are maintained.

St. Charles County; began 1947, continuing; Fred Anderson, Leader.

Address inquiries to: G. B. Herndon, Chief Fisheries Section, Conservation Commission, Jefferson City, Missouri.

2. Lake Paho Public Fishing Area

This, a 270-acre lake is managed for public fishing. It was stocked initially with largemouth bass, bluegills and channel catfish - later with walleyes. Fishing privilege, boats and bait are available for a nominal fee. Creel records are maintained.

Mercer County; began 1948, continuing; Eugene Holman, Leader.

Address inquiries to: G. B. Herndon, as in No. 1 above.

3. Hunnewell Lake

This is a 230-acre public fishing lake stocked in 1954 with largemouth bass, walleyes, channel catfish and bluegills. Fishing privilege, boats, and bait are available for a nominal fee. Creel records are maintained.

Shelby County; began 1954, continuing; William E. McDannold, Leader.

Address inquiries to: G. B. Herndon, as in No. 1 above.

4. James A. Reed Memorial Public Fishing Area

This area consisting of six lakes with a total water area of 130 acres is being developed for public fishing. The lakes have been completed recently and have not filled. This will be managed for largemouth bass, channel catfish, and bluegill fishing. A nominal fee will be charged for fishing privilege, boats, and bait.

Jackson County; began 1955, continuing.

Address inquiries to: G. B. Herndon, as in No. 1 above.

5. Small Lake Development Program

This program involves the development of lakes ranging in water area from 20 to 80 acres for public fishing. Lake sites are made available to the conservation Commission through fee simple title or by out right grant of money for the purchase of land by local participating communities. The Conservation Commission builds these lakes and manages them for bass, bluegill, and channel catfish fishing. No charge is made for fishing privilege, but the Conservation Commission is responsible for fishery management as needed.

Statewide; began 1955, continuing; G. B. Herndon, Leader.

Address inquiries to: G. B. Herndon, as in No. 1 above.

6. Trimble Wildlife Area Development

This area was developed primarily as a public shooting area for waterfowl. Fishing is available to the public in a 170-acre storage reservoir. The reservoir is stocked with largemouth bass, walleyes, bluegills and channel catfish. Fishing privilege, boats, and bait are available for a fee. Creel records are maintained.

Clinton County; began 1953, continuing; Fay Grogan, Leader.

Address inquiries to: G. B. Herndon, as in No. 1 above.

7. Duck Creek Wildlife Management Area

This is managed primarily as a public hunting area for waterfowl. Fishing is available in a 1700-acre impoundment free of charge. Boats are made available for a nominal fee. Creel records are maintained. The lake was stocked with bass, bluegills, and channel catfish.

Stoddard County; George Brakhage, Leader.

Address inquiries to: G. B. Herndon, as in No. 1 above.

8. Montrose Lake Wildlife Area

This is an 1800-acre lake created as a water supply reservoir for a steam operated electric power plant built by the Kansas City Power and Light Company. Pending the completion of an agreement between the cooperating agencies, the lake will be operated by the Conservation Commission for public fishing. It has been stocked with largemouth bass, walleyes, bluegills, and channel catfish. It will provide fishing opportunity in an area of Missouri where there is little impounded water.

Kansas City Power and Light Company cooperating; Henry County; began 1955, continuing.

Address inquiries to: G. B. Herndon, as in No. 1 above.

9. Hasler A. Poague Wildlife Management Area

This project consists of an experiment in the rehabilitation of an abandoned strip coal mine area. It is managed jointly for fishing and for quail and rabbit hunting. Part of the water area stocked initially with largemouth bass, bluegills, and channel catfish was opened for public fishing in 1955. Fishing is available free of charge.

Henry County; began 1953, continuing; Gilbert Weiss, Leader.

Address inquiries to: G. B. Herndon, as in No. 1 above.

10. Brewer Lake Reclamation

This 300-acre oxbow lake which will be opened to public fishing is located along the Mississippi River. It was treated with rotenone to remove a large population of non-game fishes and was restocked with largemouth bass, bluegills, and channel catfish. Recontamination with non-game species is being prevented with an electrical barrier. This barrier was constructed across an outlet ditch which connects the lake with the Mississippi River. Fishing privilege will be without charge.

Mississippi County; began 1955, continuing.

Address inquiries to: G. B. Herndon, as in No. 1 above.

11. Lake Management Service

This project provides an extension service to assist the public in managing and developing impounded waters. Assistance is given on private as well as publicly owned waters. This service includes guidance in developing new waters and in restoring old ones. Restoration involves removing undesirable fish populations with rotenone preparatory to restocking.

Statewide; began 1950, continuing; Gilbert Weiss, Leader.

Address inquiries to: G. B. Herndon, as in No. 1 above.

12. Development of a Dry Trout Food

After exhaustive testing in the Commission's hatcheries, a dry trout food developed by Purina Mills was adopted as the standard trout diet. No supplementary feed is required. Experiments are underway now to add a factor to the feed to produce trout with pink flesh.

Purina Mills Inc. cooperating; trout hatcheries; began 1954, continuing; A. G. Morris, Leader.

Address inquiries to: G. B. Herndon, as in No. 1 above.

13. Investigations of Stream Pollution

The purpose of this project is to investigate the effect of water pollution upon fish in Missouri streams and to provide information for law enforcement and pollution abatement. Analyses of contaminated waters are made, the source of contamination is traced, and its effect upon the fish determined.

MISSOURI (Cont. )

Statewide; began 1951, continuing; Herbert J. Fisher, Leader.

Address inquiries to: Herbert J. Fisher, Fisheries Section, Conservation Commission, 903a Elm St. , Columbia, Missouri.

14. A Study of the Effect Upon Fish of the Drawdown of Navigation Pools in the Missouri Section of the Mississippi River

Conservation agents and commercial fishermen assist in the project by reporting water conditions and fish mortality at sites affected by drawdown. Each report of fish mortality is investigated and an estimate of the fish killed is made. The Corps of Engineers, U. S. Army, cooperate by making available daily records of temperature, ice condition, snow cover, and pool elevation at each lock and dam in the study area. Commercial fishermen aid as observers.

U. S. Army Corps of Engineers cooperating; Mississippi River between Alton, Illinois, and Keokuk, Iowa; began December 1946, continuing; Herbert J. Fisher, Leader.

Address inquiries to: Herbert J. Fisher, as in No. 13 above.

15. Aerial Fishing and Recreational Count of the Missouri-Illinois Section of the Mississippi River

This project is conducted to obtain information on use of this section of the river by sport fishermen and pleasure boaters. Counts of fishing boats, boat fishermen, bank fishermen and pleasure craft are made by Illinois and Missouri observers on 16 flights scheduled from April through October. Missouri furnishes a plane and a pilot on eight flights and Illinois furnishes a plane and a pilot on the other eight flights.

Illinois Conservation Department and Illinois Natural History Survey cooperating; Missouri-Illinois section of the Mississippi River; began April 1956, to close October 1957; Herbert J. Fisher, Leader.

Address inquiries to: Herbert J. Fisher, as in No. 13 above.

16. A Statewide Continuing General Creel Census

The census is carried on to determine the utilization of the fishery resources of the State, to detect trends, and to determine the effect of regulations. Conservation agents record creel information from 20 percent of all anglers interviewed in the regular course of their duties as enforcement officers. These data are tabulated by fishery technicians. Rate of success and species composition of the catch are determined for the various watersheds and impoundments and for the major zoogeographic areas of the State. Results for previous years are available for comparison.

Statewide; began May 1946, continuing; John L. Funk, Leader.

Address inquiries to: John L. Funk, Fisheries Section, Conservation Commission, 903a Elm Street, Columbia, Missouri.

17. A Study of the Migration of Stream Fishes

This study is made to determine the extent of the movements of warm water stream fishes and to correlate, if possible, movements with season, water conditions, and population pressure. Fish collected in population studies are tagged and released. Records of tagged fish caught by fishermen are analyzed to determine for each species: (1) average time and distance traveled, (2) direction and season of greatest movement.

Statewide; began 1947, continuing; John L. Funk, Leader.

Address inquiries to: John L. Funk, Fisheries Section, Conservation Commission, 903a Elm Street, Columbia, Missouri.

18. A Study of the Important Stream Fishes in Various Missouri Watersheds

This study is being done to determine the age and rate of growth of all the important stream fishes in representative watersheds, and to detect growth trends and effects of environment. The results of this study are correlated with those of other investigations to develop a comprehensive management plan for the watershed. Information from individual watershed studies is being combined to set up a standard for statewide comparisons of fish growth. The scale samples used are collected in the population study.

Statewide; began 1947, continuing; Charles A. Purkett, Jr., Leader; reports available.

Address inquiries to: Charles A. Purkett, Jr., Fisheries Section, Conservation Commission, 903a Elm Street, Columbia, Missouri.

19. A Study of the Composition and Relative Abundance of the Fish Population in Selected Areas of Study Streams

This study is carried on to determine the composition and relative abundance of the fish population in three sample areas on each of nine watersheds. Cause of any trends observed is to be determined, if possible. One collection has been made annually since 1954 at each test section.

Statewide; began 1956, continuing; John L. Funk, Ronald E. Gumtow and Robert W. McVey, Leaders.

Address inquiries to: John L. Funk, as in No. 17 above.

20. The Abundance, Distribution, and Ecology of Forage Fishes in Streams

The objectives of this study are: (1) To determine the species composition of small fish collections made in connection with the population study, (2) to evaluate yearly fluctuations in species composition and relative abundance and, (3) to establish distribution records.

Statewide; began 1947, continuing; Perry E. Robinson, Leader.

Address inquiries to: Perry E. Robinson, Fisheries Section, Conservation Commission, 903a Elm Street, Columbia, Missouri.

21. A Study of Trends in Reproductive Success of Game, Rough, and Forage Fishes in a Missouri Ozark Stream Stocked With Fingerling Smallmouth Bass

The objectives of this study are to obtain information on, (1) the spawning success and survival of young of the important game, non-game, and forage fishes; (2) to determine the species composition and relative abundance of forage fishes; (3) to determine the effect of stocking of smallmouth bass fingerlings upon the reproductive success of the important game and non-game fishes and; (4) to develop and standardize a method for the determination of the reproductive success of game, non-game, and forage fishes in Ozark streams.

Big Piney River; began December 1956, continuing; Perry E. Robinson, Charles A. Purkett, Jr. and George G. Fleener, Leaders.

Address inquiries to Perry E. Robinson, as in No. 20 above.

22. A Study of the Species Composition and Relative Abundance of Fishes Present in a Missouri Ozark Stream Stocked with Fingerling Smallmouth Bass

This study was designed to determine the species composition and relative abundance of fishes present in a stream which was stocked annually with fingerling smallmouth bass. Stocking was done to determine the effect of stocking upon the existing population and to evaluate the rate of survival of the stocked fish. A census crew makes collections from three test sections on the stream two times annually.

Big Piney River; began 1951, to close 1958; George G. Fleener, Ronald B. Gumtow, and John L. Funk, Leaders.

Address inquiries to: George G. Fleener, Fisheries Section, Conservation

Commission, 903a Elm Street, Columbia, Missouri.

23. An Intensive Creel Census of an Ozark Stream Stocked Annually With Fingerling Smallmouth Bass

The objectives of this study are to estimate the annual yield of fish to anglers, to determine the effect of annual stocking of fingerling smallmouth bass upon fishing success, and to evaluate the cost of such stocking. An intensive creel census has been in operation since 1951. Information is collected in a systematic manner so that the results can be expanded to provide estimates of the yield for the entire season and the entire length of the stream. Fingerlings were stocked annually from 1951 to 1955. These fish were permanently marked by fin-searing so their contribution to the creel can be recognized.

Big Piney River; began 1951, to close 1958; George G. Fleener, Leader.  
Address inquiries to: George G. Fleener, as in No. 22 above.

24. An Intensive Creel Census of a Missouri Ozark Stream With a Year-round Open Fishing Season

Objectives of this study are to estimate the yield of fish to anglers and to determine the effect of the year-round open season upon the yield, especially of smallmouth bass. An intensive creel census has been in operation on the stream since 1951. The year-round open season will go into effect in 1957. By comparing before and after data, an evaluation of the effect of the year-round open season will be possible.

Niangua River; began 1951, to close 1958; John L. Funk and George G. Fleener, Leaders.

Address inquiries to: John L. Funk, as in No. 17 above.

25. A Study of Trends in Reproductive Success of Game, Rough, and Forage Fishes in a Missouri Ozark Stream with a Year-round Open Season

This study is designed, (1) to add to information on the spawning success and survival of young of the important game, non-game, and forage fishes (especially smallmouth bass); (2) to determine the species composition and relative abundance of forage fishes; (3) to determine the effect of a year-round open season upon the reproductive success of the important game and non-game fishes in an Ozark stream; (4) to develop and standardize a method for the determination of the reproductive success of game, non-game and forage fishes in Ozark streams.

Diangua River; began December 1956, continuing; Perry E. Robinson, Charles A. Purkett, Jr., George G. Fleener, Leaders.

Address inquiries to: Perry E. Robinson, as in No. 20 above.

26. A Study of the Species Composition and Relative Abundance of Fishes Present in a Missouri Ozark Stream With a Year-round Open Season

This study is designed to determine the species composition and relative abundance of fishes present in an experimental stream selected as representative of smallmouth bass streams of the Missouri Ozarks, and to determine the effect of a year-round open season upon the existing population of smallmouth bass and other important species. A population inventory has been in operation since 1951. By comparing before and after data, an evaluation of the effect of the year-round open season may be possible.

Niangua River; began 1951, to close 1958; George G. Fleener, Ronald B. Gumtow and John L. Funk, Leaders.

Address inquiries to: George G. Fleener, as in No. 22 above.

27. Investigation of the Natural Reproduction of Channel Catfish With Special Reference to Small Impoundments

This study was designed to determine the conditions necessary for effective natural reproduction of channel catfish and to devise methods for creating these conditions in small impoundments. Factors influencing the survival of fry are being investigated. Dates and success of spawning season and the effects of water turbidity, predators, competitors and suitable escape cover on survival of fry are among the factors receiving attention. A plastic sheeting curtain which serves as a chemical barrier and a plastic screening curtain which serves as a physical barrier are being used to divide ponds and allow controlled experiments.

August A. Busch Wildlife Area, Columbia and vicinity, and Hunnewell Public fish lake; began 1952, continuing; Robert W. McVey, Leader; reports available.

Address inquiries to: Robert W. McVey, Fisheries Section, Conservation Commission, 903a Elm Street, Columbia, Missouri.

28. A Fish Tagging Program for the Large Impoundments of Missouri

This project was designed to obtain an estimate of the annual harvest of game fish in relation to the available population. Fish are netted and tagged during March-June and the tags are recovered by creel census clerks, dock operators, and conservation agents.

Statewide; began 1951, continuing; Willis D. Hanson, Leader.

Address inquiries to: Willis D. Hanson, Fisheries Section, Conservation Commission, 903a Elm Street, Columbia, Missouri.

29. The Use of Inorganic Fertilizers for Fish Production in Small Lakes and Ponds

This project is designed to measure the availability of several plant nutrients when added to water, and to determine the most economical and efficient method of fertilization in Missouri farm ponds. The experimental ponds are stocked with largemouth bass in combination with bluegills, redear or pumpkinseed sunfish as a forage species.

Statewide; began 1954, continuing; Charles R. Walker, Leader.

Address inquiries to: Charles R. Walker, Fisheries Section, Conservation Commission, 903a Elm Street, Columbia, Missouri.

30. An Intensive Creel Census of White River and Little North Fork Arms of Bull Shoals Lake, Clearwater, Wappapello, Norfork Lakes, Lake Taneycomo, and the Niangua and Glaize Arms of the Lake of the Ozarks

The objective of these projects is to determine fishing yield, pressure, and quality by seasons as an aid to fish management in these impoundments.

Statewide; began 1949, continuing; Ralph M. Burress, Leader; reports available.

Address inquiries to: Ralph M. Burress, Fisheries Section, Conservation Commission, 903a Elm Street, Columbia, Missouri.

31. Censusing Fish Populations in Small Sample Areas of the Large Impounded Waters With Emulsifiable Rotenone

This project is designed to obtain quantitative population data for certain species and sizes of fish. These data are used in conjunction with the other impoundment surveys to evaluate the status of the fish populations in Missouri's big reservoirs.

Statewide; began August 1950, continuing; Ralph M. Burress, Leader.

Address inquiries to: Ralph M. Burress, as in 30 above.

32. An Investigation of the Spawning Success of Important Game and Non-game Fishes in the Large Impounded Waters in Missouri  
The two objectives of this project are: (1) To obtain a measure of the yearly spawning success of important fishes; and (2) to acquire a knowledge of the species composition and trends in relative abundance of the forage fishes. Statewide; began July 1950, continuing; Ralph M. Burress, Leader.  
Address inquiries to: Ralph M. Burress, as in No. 30 above.
33. Test Net Sampling of Fish Populations in the Large Impounded Waters in Missouri  
Test netting is carried out in many of the large Missouri impoundments in September and October to measure trends in abundance of several species of fish, to follow the development of populations in new reservoirs, and to obtain material for age and growth studies.  
Statewide; began August 1949, continuing; Willis D. Hanson, reports available.  
Address inquiries to: Willis D. Hanson, Fisheries Section, Conservation Commission, 903a Elm Street, Columbia, Missouri.
34. Evaluation of Liberalized Fishing Regulations on Non-game Fish Populations in Lake Wappapello  
The objective is to follow possible changes in the status of the non-game fish population which may result from newly liberalized fishing regulations and a controlled experimental commercial fishery.  
Lake Wappapello; began July 1956, continuing; Willis D. Hanson, Leader.  
Address inquiries to: Willis D. Hanson, as in No. 33 above.

University of Missouri

1. A Comparative Study of the Limnology of Lake Taneycomo Before and After Receiving Cold Discharge Water From a New Upstream Reservoir  
Construction is in progress on a new reservoir on the White River, Missouri, just upstream from Lake Taneycomo. The new reservoir will discharge cold water just off the reservoir bottom. It is anticipated this temperature change in the water flowing into Lake Taneycomo may modify the limnology of the impoundment. This study is to compare turbidity, temperature, chemical conditions, benthos, plankton, fish foods, and the small fish population. The Missouri Conservation Commission is working with the abundance and growth of the larger fishes.  
Lake Taneycomo; began July 1956, to close July 1958; Arthur Witt, Jr., Leader; reports available.  
Address inquiries to: Arthur Witt, Jr., Wildlife Research Unit, Stephens Hall, University of Missouri, Columbia, Missouri.
2. Age and Growth of the Longear Sunfish  
This project determines body-scale relationship, growth, time of annulus formation, and condition of longear sunfish in the Niangua and Big Piney Rivers. Missouri Conservation Commission cooperating; Niangua and Big Piney Rivers; began September 1956, to close January 1958; Donald Gasper, Leader; reports available.  
Address inquiries to: Donald Gasper, Wildlife Research Unit, Stephens Hall, University of Missouri, Columbia, Missouri.
3. A Pre-impoundment Study of Selected Fishes From the White River System, Missouri.

The remainder of the White River, in Missouri, is soon to be inundated by the construction of Table Rock Dam. This study will form a portion of a pre- and post-impoundment study of this river and will be concerned with a distributional study of the fishes in the White River and two tributary streams; Long Creek and the James River. Life history studies will be made of selected fishes which will also be present in the impoundment and will form a background for future studies of these same fishes.

Missouri Conservation Commission cooperating; Taney, Stone, and Barry Counties; began July 1956, to close September 1957; Leslie W. Knapp, Leader; reports available.

Address inquiries to: Leslie W. Knapp, Wildlife Research Unit, University of Missouri, Columbia, Missouri.

4. A Pre-impoundment Study of the Bottom Fauna in the White River System, Missouri

The White River and two tributary streams, Long Creek and James River, will soon be inundated upon the completion of Table Rock Dam. This study is to compare the qualitative and quantitative composition of the bottom fauna of these streams and to contrast the productivity of each stream. It will also form a background for future studies of the bottom fauna after impoundment.

Taney, Stone, and Barry Counties; began July 1956, to close September 1957; James P. Henley, Leader; reports available.

Address inquiries to: James P. Henley, Wildlife Research Unit, University of Missouri, Columbia, Missouri.

5. Studies of the Bottom Fauna of Two Ozark Streams

The objectives are to determine production and composition of bottom fauna, seasonal variation, habitat preferences, availability, and utilization by several small fishes.

Niangua and Big Piney Rivers; began June 1955, to close July 1957; Dave Foster, Leader; reports available.

Address inquiries to: Dave Foster, Wildlife Research Unit, Stephens Hall, University of Missouri, Columbia, Missouri.

6. Life Histories of the Black Redhorse in Two Ozark Streams

This project is concerned with development and growth, food and feeding habits, movements and behavior, as well as association and spawning.

Missouri Conservation Commission, cooperating; Niangua and Big Piney Rivers; began July 1952, to close July 1957; Milton Bowman, Leader; Reports available.

Address inquiries to: Milton Bowman, Wildlife Research Unit, Stephens Hall, University of Missouri, Columbia, Missouri.

MONTANA

Department of Fish and Game

1. Statewide Creel Census

This census is being conducted as a field survey by wardens, guides and outfitters and cooperative fishermen, with statistical data compiled and analyzed by punch card system for use in planning future development and management procedures.

Began July 1951, indefinite; \$4,400; Clinton G. Bishop, Leader; reports available.

Address inquiries to: Clinton G. Bishop, Montana State Department of Fish and Game, Helena, Montana.

2. Classification of Public Lands

This project is designed to survey State and Federal lands in Montana and to classify these according to their present and potential values for access to fishing waters. Every effort will then be made to have these lands withheld from sale.

Statewide; began July 1952, indefinite; \$7,200; Clinton G. Bishop, Leader; reports available.

Address inquiries to: Clinton G. Bishop, as in No. 1 above.

3. Cataloging the Lakes and Streams of Montana

The purpose of this project is to determine by modified measures of standard procedure the chemical, physical, and biological characteristics of the waters of the State. Coverage of the greater portion of the waters is to be superficial with the greatest effort being placed on those waters which are most important to recreational fishing. Depending upon the water involved, qualitative and/or quantitative measures of trout stream populations are made by electric fish census methods.

Statewide; began April 1951, indefinite; Frank Stefanich, Nels Thoreson, Boyd Opheim, Arthur Whitney, and Perry Nelson, Leaders; reports available.

Address inquiries to: Montana State Department of Fish and Game, Mitchell Building, Helena, Montana.

4. A Limnological Survey of the Three Forks Ponds Before and After the Application of Toxicants

A limnological survey is to be conducted on three cold water ponds approximately two miles east of Three Forks, Montana. These ponds are similar in area (approximately 20 acres) and lie adjacent to one another. Two of these ponds are now known to contain various species of warm and cold water fishes.

The limnological study will be carried on for one year and then a different commercial toxicant will be applied to each pond. The investigation will be continued for an additional year. The objective is to study the effects of these toxicants on the limnology of cold water ponds and to determine their period of toxicity and effectiveness in killing various species of fish and fish food organisms. Several ponds of similar size and characteristics are reported to be in the same area. A general survey will be made to determine which of these maintain fish populations. Those with obnoxious fish will be rehabilitated with various toxicants and the period of toxicity and success of the fish kill will be determined.

Southwestern Montana; began June 1956, to close 1958; B. R. Opheim, Leader.

Address inquiries to: Boyd R. Opheim, P. O. Box 530, Bozeman, Montana.

5. Effectiveness of Smith Lake Rearing Pond

The primary objectives are to measure the actual production of Smith Lake as received from a known number of fry cutthroat trout planted and to determine the economics of the operation considering the cost of operation and the value of the yearling fish produced.

Flathead County; began June 1950, to close April 1957; \$700; Frank A. Stefanich, Leader.

Address inquiries to: Frank A. Stefanich, Route 7, Box 50-B, Kalispell, Montana.

6. The Effects of Logging on Pinkham Creek's Fish Population

The purpose of this project is to measure the standing fish population of Pinkham Creek over a period of years to the end that any changes which may develop in the population may be measured. This area of virgin timber is now being logged. If this logging affects the aquatic environment, it is expected that this change will be reflected in the fish population.

Lincoln County; began August 1951, to close April 1957; \$400; Frank A. Stefanich, Leader; reports available.

Address inquiries to: Frank A. Stefanich, as in No. 5 above.

7. Establishing Measures of Abundance of Cutthroat Trout in Ashley Lake

At one time the cutthroat trout were abundant in Ashley Lake and little effort was required to catch a limit. Due to faulty management, the numbers have dwindled to a dangerous low. This lake is used for spawn taking, and traps are operated on four tributaries. In the last three years, the number of cutthroat trout fry planted varied from 50 to 100 per surface acre of the 3,200-acre lake. Relatively few trout have been recaptured that have been tagged in the traps since the project started. The purpose of the project is to determine the relative abundance of trout in this lake so that the effects of corrective management may be noted.

Flathead County; began May 1951, closed November 1956; \$700; Frank A. Stefanich, Leader; reports available.

Address inquiries to: Frank A. Stefanich, as in No. 5 above.

8. Development of a Manual on Trout Culture

The objective is to assemble and summarize material from the available literature into a manual on trout culture. A library on trout culture will be kept up to date and all acquisitions will be author and subject indexed. First hand experiences with disease, diet or other fish cultural problems will be used to supplement the literature in preparing topical additions or corrections for the present manual. Extensive lists of pertinent literature references will be included with each summary added to the manual.

Statewide; began May 1953, continuing; \$500; Jack E. Bailey, Leader; reports available.

Address inquiries to: Jack E. Bailey, P. O. Box 602, Philipsburg, Montana.

9. Study of the Effects of Various Fish Cultural Practices on Winter Survival, Growth, and Condition of Catchable-sized Hatchery Trout Planted into a Mountain Stream.

Data has been collected and is being analyzed relative to the effects of high stocking rates on survival, growth, and condition of resident and planted trout. No fishing pressure other than natural predation is exerted upon the population. Serially numbered metal jaw tags are used for marking the fish. A shocking device is used to census the entire study area twice a year. Fish barriers are maintained.

In an effort to measure the effects of transportation on overwinter survival in Flint Creek, marked rainbow trout were hauled to the stream via three different trip lengths based on actual planting trips made under Montana's present planting program. The shortest trip required only one hour while the longest required six hours in a 150-gallon, overhead spray tank. Data on overwinter survival of these fish will be obtained during the 1957 spring shock census.

Montana Agricultural Experiment Station cooperating; Flint Creek; began May 1954, indefinite; \$15,000; Jack E. Bailey, Leader; reports available.

Address inquiries to: Jack E. Bailey, as in No. 8 above.

10. Marias River Rehabilitation Restoration

Rehabilitation of the Marias River drainage above Tiber Dam was accomplished during 1954 and 1955. The major objectives of this rehabilitation work was the removal of carp and goldeneye, the decimation of other undesirable species, and their replacement by trout in approximately 1,000 miles of streams above Tiber Dam.

Checking for isolated or localized breeding populations of carp was continued through 1956.

Planting of rainbow trout in Tiber Dam and the Marias drainage is the largest part of this project, the planning for which is yet to be completed during 1957-58.

Marias River drainage; began May 1954, to close April 1957; \$14,800; Nels A. Thoreson, Leader; reports available.

Address inquiries to: Nels A. Thoreson, P. O. Box 252, Belt, Montana.

11. Biology of the Squawfish and Columbia River Chub in the Blackfoot Drainage

The objectives of this project are to determine the distribution, spawning periods and areas of the squawfish, Ptychocheilus oregonensis, and the Columbia River chub, Mylocheilus caruinus, in the Blackfoot drainage. The life histories of these two non-game species are being investigated to better ascertain the necessity and best methods of directing control measures on them, especially prior to the advent of new impoundments near the headwaters of Montana's west slope streams.

Montana State College cooperating; Missoula, Powell, and Lewis and Clark Counties; began May 1956, to close April 1958; \$4,500; Arthur N. Whitney, Leader.

Address inquiries to: C. W. Hill, Jr., Z and E Department, Montana State College, Bozeman, Montana.

12. Comparison of Fish Populations of Six Clearwater Lakes

The purpose of this project is to obtain indices of relative abundance of the various species of fish in six of the Clearwater River chain of lakes in order to better evaluate different management measures used on individual lakes in the chain. To reduce the effects of seasonal and weather variations in net catches, the lakes are netted simultaneously during one week in June by one two-man crew on each lake. Net sets are recorded on maps and nets are re-set in approximately the same locations each year. Indices of abundance are computed as fiducial intervals at the 80 percent probability level of the catch per net-night by species. Standard lake survey information and age and growth data are also taken. This job is in its second year.

Missoula County; began May 1955, to close April 1957; \$3,500; Arthur N. Whitney, Leader; reports available.

Address inquiries to: Arthur N. Whitney, Montana State Fish and Game Department, District No. II, P. O. Box 1138, Missoula, Montana.

13. Northeastern Montana Fishery Study

In Fort Peck Reservoir and to some extent in the immediate drainage, the goldeye is very abundant. To augment and to bring together the somewhat scattered and fragmentary information on the goldeye a study is being made. To date, scale samples have been taken, stomachs and gonad samples have been preserved, and observations have been recorded. Scale samples are also being taken from sauger and yellow perch.

Four cool water ponds have this year been made available for public

fishing. One of these ponds was rehabilitated last year and in September 1956 was stocked with fingerling rainbow trout. The other three ponds are relatively clean and will be stocked in 1957. Studies will be made to determine the best means of stocking trout ponds, especially as to whether or not it is more feasible to plant larger fish in the face of an existing trout population or to rehabilitate the pond and stock with small fingerlings or fry.

Northeastern Montana; began May 1952, to close April 1959; \$7,500; William Alvord, Leader.

Address inquiries to: William Alvord, P. O. Box 394, Fort Peck, Montana.

14. The Relationship of Cutthroat Trout and Yellow Perch in Lower Thompson Lake

The relationship of yellow perch and cutthroat trout have been studied in 1952 and 1953 in Middle Thompson and Lower Thompson Lakes in order to determine any weak link in the life cycle of the perch. Perch fry were effectively killed with rotenone while congregated in schools along the shoreline. The entire shoreline of Lower Thompson Lake was treated with "Fish-Tox" in July, 1956, to eradicate these fry. After the poison had dissipated, both Middle and Lower Thompson Lakes were planted with about 300 fish per surface acre. One of the objectives of this project is to determine the effects of partial poisoning and subsequent planting of fish in one lake as compared with planting and no poisoning in another lake. The over-all objective is to determine the most economical method to develop a fishery in a lake that has a started yellow perch population.

Lincoln County; began May 1952, to close February 1957; \$2,000; Frank A. Stefanich, Leader; reports available.

Address inquiries to: Frank E. Stefanich, as in No. 5 above.

State University

1. A Relationship of an Intergeneric Hybrid in Relation to its Parental Genera (Mylocheilus and Ptychocheilus)

This project consists of correlating numbers of hybrids with the parental species through various parts of Flathead Lake and various seasons of the year.

State Fish and Game Department cooperating; Flathead Lake; began June 1950, to close September 1957; Royal Bruce Brunson, Leader.

Address inquiries to: Royal Bruce Brunson, Assoc. Professor of Zoology, Montana State University, Missoula, Montana.

2. Limnological Surveys of Various Waters of Western Montana

The objectives are to map various lakes and include with the map, a survey of the plankton, benthos, nekton, and physico-chemical conditions of the lake at specified times.

Western Montana; began August 1949, continuing; \$100; Royal Bruce Brunson, Leader.

Address inquiries to: Royal Bruce Brunson, as in No. 1 above.

3. A Limnological Study of Flathead Lake

The objectives are to determine the major physical and chemical factors, the plankton, the benthos, and a hydrographic study of the lake.

Flathead Lake; began June 1956, indefinite; irregular; Royal Bruce Brunson, Leader.

Address inquiries to: Royal Bruce Brunson, as in No. 1 above.

## MONTANA (Cont.)

### 4. Distributional Studies of the Fishes of Flathead Lake

The objectives are to determine geographical and vertical distribution of the various species of fishes through the various seasons of the year as found in Flathead Lake.

State Fish and Game Department cooperating; Flathead Lake; began June 1951, to close August 1957; \$300; Royal Bruce Brunson, Leader.

Address inquiries to: Royal Bruce Brunson, as in No. 1 above.

### 5. Ecology of Salvelinus malma in the Flathead Drainage of Western Montana

The objectives are to study the life history, food habits, migration, and general ecology of the Dolly Varden trout.

State Fish and Game Department cooperating; Flathead Lake and North and Middle Forks of the Flathead River; began October 1949, indefinite; \$300; Royal Bruce Brunson, Leader.

Address inquiries to: Royal Bruce Brunson, as in No. 1 above.

## NEBRASKA

### Game, Forestation and Parks Commission

#### 1. Fisheries Inventory and Investigations

The objectives are to determine the status of the fish populations and conditions in the many diversified types of waters in Nebraska, and to obtain information for better management practices for improvement of fishing. The State has been divided into five districts, with a fishery manager in each district. Each manager is assigned study jobs depending on types of water and fish present.

The project covers study of trout streams, large and small natural sand-hill lakes, power and irrigation reservoirs, sandpit-type lakes, and smaller artificial lakes.

Statewide; began July 1954, indefinite; \$50,000; Glen R. Foster, Leader.

Address inquiries to: Glen R. Foster, Game, Forestation and Parks Commission, State House, Lincoln 9, Nebraska.

#### 2. Big Alkali Lake Development

The objectives are to provide a public access road to one of Nebraska's largest natural meandered lakes, and to develop a parking and picnic area for fishermen. A lease agreement was obtained from the landowner for one and one-half miles of road and parking and picnic area. The landowner was given exclusive concession rights for cabins, boats, and refreshments. He also provides a fish-cleaning service. The State furnished the public facilities such as boat docks and ramps, sanitary facilities and does the maintenance on the road and picnic area.

Cherry County; began June 1956, closed October 1956; \$6,234; Glen R. Foster, Leader.

Address inquiries to: Glen R. Foster, as in No. 1 above.

#### 3. Verdon Lake Development

Verdon State lake, a 33.5 acre lake, was drained and the entire lake bed deepened an average of 1.5 feet. Dykes were raised and widened, and the water level will be raised approximately two feet, making the lake approximately three and one-half feet deeper than formerly.

Cherry County; began May 1956, closed October 1956; \$31,684; Glen R. Foster, Leader.

Address inquiries to: Glen R. Foster, as in No. 1 above.

U. S. Fish and Wildlife Service, Branch of Game-fish and Hatcheries

1. Experimental Use of Toxaphene in Hardwaters

The objective is to determine minimum dosage of toxaphene necessary to kill carp and bullheads in hardwater lakes of the Great Plains area. Four dosage levels were used in six experimental lakes and ponds.

Nebraska Game, Forestation and Parks Commission cooperating; Valentine National Wildlife Refuge; began September 1956, to close June 1957; R400; Robert W. Sharp, Leader; reports available.

Address inquiries to: U. S. Fish and Wildlife Service, 1006 West Lake Street, Minneapolis 8, Minnesota.

NEVADA

Fish and Game Commission

1. Pyramid, Walker, and Tahoe Lakes Project

The objective is to determine if the fishing in Pyramid Lake can be restored by developing natural propagation in the lower Truckee River. If this is not possible then it will point out the success of artificially stocking the lake with various sized trout.

Walker lake is already responding to a stocking program. Information is being gathered to determine if a fish of a smaller size than has been stocked previously can be utilized successfully.

At lakes Tahoe and Topaz, basic environmental investigations and studies to determine the effect of fingerling and reared trout plantings on the fishery of the two lakes are under way.

Began July 1954, to close June 1957; \$26,000; V. K. Johnson, R. C. Corlett, and R. C. Allan, Leaders.

Address inquiries to: Nevada Fish and Game Commission, Box 678, Reno, Nevada.

2. Lahontan Project

The objectives are to obtain a comprehensive picture of the environmental factors which exist in Lahontan and Ryepatch Reservoirs, Stillwater Marsh, Indian Lakes, and Washoe Lakes, and to determine what can be done to improve these factors to improve the sport fishery on these bodies of water.

Indian Lakes, Stillwater, Washoe Lake, Lahontan and Ryepatch Reservoirs; began July 1954, to close June 1957; \$15,000; R. C. Sumner, Leader.

Address inquiries to: R. C. Sumner, 385 West Richards Street, Fallon, Nevada.

3. Stream and Lake Survey

This project provides a complete physical inventory of all streams and small lakes in the State to determine the conditions of each stream and lake in regard to fish life with recommendations for improvements and future stocking policies.

Statewide; began November 1951, to close July 1958; \$20,000; T. C. Frantz and D. B. Thurston, Leader.

Address inquiries to: T. C. Frantz, 820 Evans Avenue, Reno, Nevada, or D. B. Thurston, 1117 Sewell Drive, Elko, Nevada.

University of Nevada

1. The Fishes of Nevada

The objectives are to describe, key, and characterize taxonomically and ecologically, the fishes of the State so that this information will be available to fish and game biologists, University personnel, and biologists in general.

State Fish and Game Commission cooperating; statewide; began June 1952, to close 1957; \$7,500; Ira LaRivers, Leader.

Address inquiries to: Ira La Rivers, Biology Department, University of Nevada, Reno, Nevada.

2. Limnology of Pyramid Lake

The project was initiated in 1948 in cooperation with the State Fish and Game Commission as a research effort of the Biology Department of the University of Nevada to determine methods of reviving the once extensive cut-throat trout fishery of the lake. To date, it has included annual surveys of the physical, chemical and biological characteristics of the lake on the part of both the State Fish and Game Commission and the University of Nevada.

State Fish and Game Commission and Piute Indian Tribal Council cooperating; began August 1948, to close 1958; \$1,000; Ira La Rivers, Leader.

Address inquiries to: Ira La Rivers, as in No. 1 above.

3. The Algae of Nevada

The project was officially initiated in the spring of 1952. Its objectives are: (1) To determine the species of algae present in the State and note their distributions, and (2) thereby to make taxonomic and ecologic information of these basic food chain plants available to Nevada fish and game technicians as well as to fish management studies which the Biology Department of the University of Nevada has under way.

Chicago Museum of Natural History cooperating; statewide; began March 1952, to close 1957; \$500; Ira La Rivers, Leader.

Address inquiries to: Ira La Rivers, as in No. 1 above.

NEW HAMPSHIRE

Fish and Game Department

1. Bass Management Investigations

The project objectives are to instigate and evaluate management techniques to improve and promote better fishing for warm water species, primarily bass at present. The effect of total and partial reclamation is being studied along with various fish population control measures, forage studies, original introductions of bass into waters without the aid of total reclamation, control of parasites, primarily bass tapeworm, and the development of sources of parasite free largemouth and smallmouth bass fry and adults.

Statewide; began May 1950, to close April 1960; \$20,000; Arthur D. Riel, Leader; reports available.

Address inquiries to: Arthur D. Riel, Management and Research Division, New Hampshire Fish and Game Department, 34 Bridge Street, Concord, New Hampshire.

2. Bass Tapeworm Survey

The primary objectives of this survey were: (1) To determine the degree to which the smallmouth bass and other species of fish were infected with the

bass tapeworm (Proteocephalus ambloplitis), and (2) to record which bodies of water were free from the parasite in order to determine future stocking or reclaiming policies.

Southern New Hampshire; began May 1955, closed December 1956; \$8,000; George R. Morrison, Leader.

Address inquiries to: George R. Morrison, Fisheries Biologist, New Hampshire Fish and Game Department, 34 Bridge Street, Concord, New Hampshire.

3. Trout Stream Management Investigations

This project was designed as a pilot study preliminary to the establishment of more intensive management recommendations for New Hampshire's trout streams. A preliminary study indicated that the information most needed was a study of wild fish populations and a study of the fishery. Work conducted to date has consisted primarily of creel census and population studies. Data thus collected have lead to some management recommendations which have been applied on a statewide basis such as: removal of legal length limits, extension of angling season, and opening closed breeder streams. Other recommendations such as specific stocking policies are to be applied on an individual watershed basis. Plans are to study all trout watersheds in order to establish sound management plans for each.

Swift River Watershed; began May 1952, to close March 1957; \$10,000; Arthur E. Newell, Leader; reports available.

Address inquiries to: Arthur E. Newell, Senior Fisheries Biologist, New Hampshire Fish and Game Department, 34 Bridge Street, Concord, New Hampshire.

4. The Baboosic Watershed Survey

The Baboosic Brook Watershed Protection Project was set up as one of 62 pilot demonstrations over the nation under the Soil Conservation Act of 1935. The basic objectives involved were: (1) to discover the best means of soil, water, forest, and wildlife protection and improvement which would be accomplished within a short period of concentrated effort on a small watershed; (2) to set precedents and develop procedures of local, state, and federal cooperation for the benefit of watershed residents; and (3) to accomplish as much actual improvement and development work as possible within the watershed during a 5-year period.

The project was completed and a final report has been drafted.

U. S. Soil Conservation Service cooperating; Hillsborough County; began July 1954, closed November 1956; \$5,000; James A. Lee, Leader; reports available.

Address inquiries to: Hilbert R. Siegler, Management and Research Division, Concord, New Hampshire.

5. Rotenone Detoxification Studies

The objectives are to test and develop methods which might more rapidly oxidize rotenone in reclaimed ponds in order to facilitate earlier restocking. Both potassium permanganate and chlorine are being tested. In the laboratory both have shown considerable promise. They are now being tested in the field.

Fish and Game Department cooperating; New Hampshire University; began June 1953, to close June 1957; \$800; C. F. Jackson, Leader.

Address inquiries to: C. F. Jackson, Engineering Experiment Station, University of New Hampshire, Durham, New Hampshire.

6. Ecological Study of the Squam Lakes

The primary objective was to make a comprehensive study of the Squam

## NEW HAMPSHIRE (Cont.)

Lakes, including their physical and chemical make-up, the fishing pressure and success on these lakes both in summer and winter, and the composition of the existing fish populations. These data are to be used in the formulation of a long-range management plan.

New Hampshire University cooperating; Holderness, Sandwich, and Moultonboro Counties; began May 1949, closed December 1956; \$8,000; Ronald E. Towne, Leader; reports available.

Address inquiries to: Ronald E. Towne, New Hampshire Fish and Game Department, 34 Bridge Street, Concord, New Hampshire.

## NEW JERSEY

### Division of Fish and Game

#### 1. Marine Fisheries Investigations

The objectives are: (1) To determine cause of small fluke in Raritan Bay; (2) to investigate possible relationship between porgies taken in Sandy Hook Bay and those from adjacent off-shore waters; (3) to assist on coast-wide striped bass research; (4) to determine if skin divers compete with line fishermen; (5) to census fishermen at Island Beach, an area representative of surf fishing along central Jersey shore.

Coastal areas; began 1955, to close 1957; \$8,000; Paul E. Hamer, Leader.

Address inquiries to: Paul E. Hamer, New Jersey Fisheries Laboratory, 126 North Main Street, Milltown, New Jersey.

#### 2. Management of Small Park Ponds

The objective is to determine how small park ponds (under 5 acres), which inevitably contain badly stunted and trash species, can best be managed to produce fishing, primarily for youngsters.

Ponds are treated as follows: stocked with adult bass and bluegills, adult hatchery bluegills, adult panfish obtained from salvage operations, and reclaimed and stocked as above.

Statewide; began 1954, to close 1958; \$6,500; Roy R. Younger, Leader.

Address inquiries to: Roy R. Younger, New Jersey Fisheries Laboratory, 126 N. Main Street, Milltown, New Jersey.

#### 3. Evaluation of Survival of Hatchery-reared Largemouth Bass

Objectives and description of the project: (1) To evaluate the survival rate of fingerling largemouth bass stocked under various conditions, including ponds where bass are not reproducing successfully and ponds where reproduction appears adequate. (2) To evaluate the survival rate of stocking adult bass in ponds containing an "adequate" bass population, ponds containing excess and/or stunted species of fish, and reclaimed ponds.

Statewide; began 1955, to close 1958; \$4,000; Roy R. Younger, Leader.

Address inquiries to: Roy R. Younger, as in No. 2 above.

#### 4. Salmonoid Stocking in "Marginal" New Jersey Lakes

The objectives are: (1) To obtain an estimate of the total harvest of salmonoids from any given stocking; (2) to determine size and species producing best results; (3) to obtain an estimate of the number and species of "holdover" trout or salmon taken in succeeding years; (4) to attempt to evaluate the effects, if any, that the stocking of trout would have on other important species in the lake.

Lakes Hopatcong, Mountain Lake and Pliff Lake, in Warren and Sussex Counties; began April 1953, to close 1958; \$3,000; Roland F. Smith; reports available.

## NEW JERSEY (Cont.)

Address inquiries to: Roland F. Smith, New Jersey Fisheries Laboratory, 126 North Main Street, Milltown, New Jersey.

### 5. Acid Water Studies

This project involves studies on highly acid waters including the possibility of establishing sea-run trout populations in certain coastal streams, fertilization and alkalization of streams and impoundments, improvement of substrate of stream bottoms, and studies on fertility and productivity.

Southern New Jersey; began 1952, indefinite; \$500; Roland F. Smith and A. Bruce Pyle, Leaders; reports available.

Address inquiries to: Roland F. Smith, as in No. 4 above.

### 6. Poll of License Holders

The objective is to develop a technique of censusing holders of New Jersey fishing licenses that will enable the securing of data or trends pertaining to fishing success, fisherman preferences, and habits.

Statewide; began 1955, indefinite; \$2,000; Philip Crutchfield, Leader.

Address inquiries to: Philip Crutchfield, New Jersey Fisheries Laboratory, 126 North Main Street, Milltown, New Jersey.

### 7. Statewide Creel Census

The objectives are: (1) To obtain data relative to harvest, fishing effort, species composition, along with rainfall, temperature, surface activity, etc., that may be employed to provide time contrasts on a series of warm water non-acidotrophic New Jersey lakes; (2) to establish a mean trend in fishing effort, species composition, and total effort over a period of years; (3) to locate those lakes, or areas where the harvest and/or fishing effort is changing relative to the mean trend; (4) to provide a basis for measuring the success or failure of certain management techniques that might be tried, for example, stocking; and (5) to locate lakes where "real" declines in the standing crop of any given species are being experienced and, perhaps equally important, to objectively eliminate situations wherein troubles are reported to exist but which, in fact, do not.

Statewide; began 1955, indefinite; \$6,000; A. Bruce Pyle, Leader; reports available.

Address inquiries to: A. Bruce Pyle, New Jersey Fisheries Laboratory, 126 North Main Street, Milltown, New Jersey.

### 8. Distribution of Fishes in New Jersey

A general survey of the species of fishes present and their distribution in the State.

Statewide; began 1950, indefinite; Roland F. Smith, Leader; reports available.

Address inquiries to: Roland F. Smith, as in No. 4 above.

### 9. Destruction of Fish Eggs Through Use of Chemicals

The objective is to test the feasibility of pan fish control through destruction of their eggs with chemicals. Preliminary tests indicate that copper sulfate will kill common sunfish eggs in 10 minutes when a large crystal is dropped into the nest depression. Yellow perch eggs were destroyed to a lesser degree by using a combination of copper sulfate dust for suspended masses and crystals for egg masses on the bottom. It was estimated that 85 percent of perch eggs were destroyed in a 63-acre pond and subsequently no young-of-the-year were found during summer and fall rotenone sampling. Common sunfish nests will be destroyed on at least two park ponds and yellow

perch eggs again destroyed in the 63-acre lake.

Specific lakes; began March 1953, to close November 1957; \$500; Alban R. Essbach, Leader; reports available.

Address inquiries to: Alban R. Essbach, New Jersey State Fisheries Laboratory, 126 North Main Street, Milltown, New Jersey.

10. Population Manipulation

The biological changes brought about by manipulating populations will be measured by creel census, analysis of growth, and changes in population as shown by net catches.

Statewide; began March 1953, to close 1957; \$7,000; Alban R. Essbach, Leader; reports available.

Address inquiries to: Alban R. Essbach, New Jersey State Fisheries Laboratory, 126 North Main Street, Milltown, New Jersey.

11. Introduction of New Game and Panfish Species

The objective is to attempt to establish the striped bass (Roccus lineatus) in several lakes. The major purpose is to provide an additional predator large enough to utilize the large golden shiners and miscellaneous fishes.

The channel catfish will be used in park ponds where they should be easier to manage and more desirable than other game and pan species. The redear sunfish will be utilized in small impoundments as more desirable because of its low reproductive potential and larger size.

Central and northern New Jersey; began May 1953, indefinite; \$1,000; Alban R. Essbach, Leader; reports available.

Address inquiries to: Alban R. Essbach, as in No. 10 above.

12. Introduction of New Forage Species

The objective is to investigate the possibility of introducing forage species that would be available as forage throughout their life span, non-competitive to game fish, and prolific and abundant.

The saltwater spearing and anchovy have become landlocked in two fresh water impoundments and their potential as forage will be investigated. Landlocked herring are common in larger New Jersey lakes and will be stocked in smaller impoundments and weedy lakes where they do not now exist. Freshwater shrimp have been found in a specific watershed and are being investigated as an intermediate food for bass fry at the State Fish Hatchery, and as forage in ponds.

Statewide; began May 1953, indefinite; \$300; Alban R. Essbach, Leader; reports available.

Address inquiries to: Alban R. Essbach, as in No. 10 above.

13. Pickerel Ice Census

The objectives are: (1) To evaluate the effects of the 15-inch minimum size limit on pickerel in those lakes where it has been adopted; (2) to obtain routine population and fishing statistics on pickerel from several heavily fished lakes; and (3) to obtain census data on yellow perch and other species taken through the ice.

Northern New Jersey lakes; began January 1950, to close January 1958; \$1,000; Roland F. Smith, Leader; reports available.

Address inquiries to: Roland F. Smith, as in No. 4 above.

14. Studies on the Landlocked Alewife, Pomolobus pseudoharengus, in Lake Hopatcong

The landlocked alewife is known to be a very important forage fish in

## NEW JERSEY (Cont.)

many New Jersey lakes. It seems desirable to learn more about the life history and ecological requirements of this fish. Since it is also an important bait fish, information relative to the procurement and handling of this fish is also desirable.

Rutgers University cooperating; Lake Hopatcong; began June 1953, indefinite; \$200; Richard Gross; reports available.

Address inquiries to: Richard Gross, New Jersey State Fisheries Laboratory, 126 North Main St., Milltown, New Jersey.

### 15. Lake and Pond Reclamation

The objective is to reclaim lakes and ponds, presently inhabited by undesirable fishes, for species deemed more desirable.

Statewide; began October 1952, indefinite; \$1,000; reports available.

Address inquiries to: Roland F. Smith, as in No. 4 above.

### 16. New Jersey Lake and Pond Survey

The objectives are to obtain information on public lakes, ponds, and impoundments necessary for the formulation of plans for their management.

Statewide; began June 1950, indefinite; \$2,000; Richard Gross and Roland F. Smith, Leaders; reports available.

Address inquiries to: New Jersey State Fisheries Laboratory, 126 North Main Street, Milltown, New Jersey.

### 17. Aquatic Weed Control

The objectives are to develop and test practical aquatic weed control methods.

Statewide; began December 1951, closed December 1956; \$6,000; Robert K. Huckins, Leader; reports available.

Address inquiries to: Robert K. Huckins, New Jersey State Fisheries Laboratory, 126 North Main Street, Milltown, New Jersey.

## NEW MEXICO

### Department of Game and Fish

#### 1. Fisheries Investigations of District No. 4

A basic survey of waters of Lower Pecos Valley has been initiated to determine the carrying capacity, food content, water quality, and to readjust the fish stocking policy. The investigation determines waters requiring extensive management for trash fish removal, stream and lake improvement, and reservoir development.

The Pecos River fish barrier and trap is being evaluated with respect to effects on sport fishing on the Pecos River below trap.

Southeastern New Mexico; began February 1954, to close February 1957; \$10,000; William H. Morley, Leader; reports available.

Address inquiries to: Department of Game and Fish, P. O. Box 2060, Santa Fe, New Mexico.

#### 2. Fisheries Investigations of District No. 2

A basic survey of drainages into the Rio Grande from east of Albuquerque to Colorado line is under way. This survey determines the carrying capacity, food content, water quality, and provides a basis for readjusting the fish stocking policy. The investigation also concerns waters requiring extensive management for trash fish removal, stream and lake improvement, and reservoir development.

A comparison of the catch of trout taken by day and night angling on the Rio Grande is made to determine whether opening the trout season to night angling would be detrimental.

North central New Mexico; began April 1956, to close 1959; \$9,500; W. H. Wolfrum, Leader.

Address inquiries to: As in No. 1 above.

3. Food Habits of Mergansers

The objective of this project is to obtain information on the food habits of the merganser with particular reference to ratio of game to non-game fish entering the diet. Large numbers of these birds accumulate on certain New Mexico Reservoirs.

Statewide; began February 1954, to close 1957; \$3,400; Austin A. Roberts, Leader.

Address inquiries to: As in No. 1 above.

4. Fisheries Investigations of District No. 3

A basic survey is under way concerning waters in Socorro, Bernalillo and McKinley Counties south of Highway 66 and those waters in Catron, Dona Ana and Sierra Counties that are tributary to the Rio Grande River. This basic fisheries survey is to determine the carrying capacity, food content, water quality, and to provide a basis for readjusting the fish stocking policy. The investigation also concerns waters requiring extensive management for trash fish removal, stream and lake improvement, and reservoir development.

An investigation is under way to determine a practical means of removing rough fish from Elephant Butte Lake. This experimental work is to be done with baiting or finding concentrations of rough fish in coves around the lake and then using rotenone as the agent to kill the rough fish. Carp are principally the fish to be removed in these experiments.

Southwestern New Mexico; began 1954, to close 1957; \$1,500; Earl H. Huntington, Leader.

Address inquiries to: As in No. 1 above.

5. Fisheries Investigations of District No. 1

A basic survey of the following drainage areas: Chama River, San Juan River, Rio Los Pinos and Santa Clara Creek and that portion of the Rio Grande between Otowi and Velarde. This survey determines the carrying capacity, food content, water quality, and provides a basis for readjusting the fish stocking policy. The investigation concerns waters requiring extensive management for trash fish removal, stream and lake improvement, and reservoir development. The cause of dorsal lesions on rainbow trout in some of the State trout hatcheries is being investigated to determine whether solar radiation or basic chemical composition might be a causing factor, as well as turbidity of the water. A bacterial investigation of dorsal lesions is made to see whether any of the antibiotics or sulfas might effect a cure.

Northwestern New Mexico; began April 1956, to close 1959; \$10,800; Alfred W. Hill, Leader; reports available.

Address inquiries to: As in No. 1 above.

U. S. Fish and Wildlife Service, Branch of Game-fish and Hatcheries

1. Development and Tests of Fish Loading Devices

The objective is to procure, fabricate, and test equipment for loading fish into tank trucks from production units, thereby reducing manual labor. Equipment includes a modified California conveyor belt loader, a boom and container

with automatic scale, and a track mounted carrier. The former two concern trout, whereas the latter is for use at pondfish stations.

Headquarters - Albuquerque; began May 1956, to close 1957; \$3,000.

Address inquiries to: Regional Director, U. S. Fish and Wildlife Service, P. O. Box 1306, Albuquerque, New Mexico.

## NEW YORK

### Conservation Department

1. Experimental Work in a Brook Trout Lake, Big Moose Lake, Infested With Yellow Perch

The purpose of this project is to find if it is possible to produce brook trout fishing in a brook trout lake, physically unsuitable for reclamation, that is infested with yellow perch. Control of the yellow perch population by spawn removal and extensive stocking of various sizes and species of trout or salmon marked by fin clipping is being tried.

Big Moose Fish and Game Club cooperating; began April 1950, to close March 1957; \$1,000; D. G. Pasko, Leader.

Address inquiries to: D. G. Pasko, New York Conservation Department, P. O. Box 84, Route 37 - Theresa Road, Watertown, New York.

2. Resurvey of the Waters

The purpose is to bring the stocking and management policies up to date on the various waters studied. These included: Upper Hudson, Mohawk-Hudson, Lower Hudson, Delaware, Oswego, Allegheny, Lake Ontario, and Grass Watersheds.

Statewide; began April 1954, to close March 1957; \$24,000; C. W. Greene, Leader.

Address inquiries to: C. W. Greene, New York State Conservation Department, Broadway Arcade Building, Albany 1, New York.

3. Game Fish Reclamation Investigations

Preliminary investigations on a large number of waters are handled including depth sounding by echo-sounder, biological study, planning of barriers to fish migration and determination of general desirability and practicability of undertaking rotenone treatment.

Northern New York; began April 1956, to close March 1959; \$11,670; R. C. Brewer, Leader.

Address inquiries to: R. G. Zilliox, New York State Conservation Department, Adirondack Fisheries District, Ray Brook, New York.

4. Investigations on Control of Water Pollution

Field investigations are carried on as a part of the classification surveys by Water Pollution Control Board. Fish kills or other critical pollution is investigated relative to biological and chemical data as relating to enforcement of the Conservation Law on pollution. Laboratory studies are carried on by bio-assay methods to determine levels of toxicity to fish.

Water Pollution Control Board; statewide; began July 1940, continuing; \$20,000; G. E. Burdick, Leader; reports available.

Address inquiries to: G. E. Burdick, New York State Conservation Department, Broadway Arcade, Albany 1, New York.

5. Lake Erie and Lake Ontario Fisheries Investigations

In order to provide a continuous record of catch and status of the fishing in New York waters of the Great Lakes, a survey is in progress through the commercial fishermen including studies bearing on angling resources.

U. S. Fish and Wildlife Service cooperating; began 1950, indefinite; \$3000; W. G. Bentley, Leader; reports available.

Address inquiries to: U. B. Stone, New York State Conservation Department, 2130 Scottsville Road, Scottsville, New York.

6. Muskellunge Management Study

This is a continuing study of the resource, involving checks during the annual netting for spawn, tagging work, and inventory of angling catch for management purposes. It also includes survival checks of muskellunge planting in several waters by the fin-clip method.

Chautauqua Lake and several smaller lakes; began 1941, indefinite; \$1500; U. B. Stone, Leader.

Address inquiries to: U. B. Stone, as in No. 5 above.

7. Lake Champlain Ice Fishing Census

The project involves creel census sampling by game protectors, aeroplane counts of anglers, and analysis of catch data.

Vermont Department of Conservation and Development, cooperating; began 1950, to close 1958; \$1,000; R. G. Zilliox, Leader; reports available.

Address inquiries to: R. G. Zilliox, as in No. 3 above.

8. Adirondack Trout Restoration Project

This is a combination of management and research, whereby a large number of lakes and ponds are reclaimed annually for trout production. Checks of results are made including efficiency of destruction of fish by rotenone treatment and of trout stocking. Brook trout is the principal species with some experiments being conducted with "splake" (hybrid brook x lake trout).

Northern New York; began 1950, indefinite; \$17,000; R. G. Zilliox, Leader; reports available.

Address inquiries to: R. G. Zilliox, as in No. 3 above.

9. Control of Light Intensity to Induce Early Egg Production in Hatchery Trout

Much earlier trout eggs are produced through control of light intensity beginning in the spring. Although this is now a standard procedure further work to improve the method is in progress.

Randolph and DeBruce Hatcheries; began 1950, indefinite; \$200; K. B. Nichols, Leader.

Address inquiries to: K. B. Nichols, New York Conservation Department, Albany, New York.

10. St. Lawrence River and Lake Ontario Smallmouth Bass Investigation

The purpose is to obtain facts basic to management, through tagging and migration studies. A study of bass planting by use of fin-clipped fish is also included.

Began 1941, indefinite; \$500; D. G. Pasko, Leader; reports available.

Address inquiries to: D. G. Pasko, as in No. 1 above.

11. Lake Ontario Lake Trout Investigation

This is a joint project involving planting of marked (fin-clipped) lake trout supplied by New York and Ontario for the purpose of developing methods for building up the lake trout resource in Lake Ontario and to make biological

studies bearing on lake trout management.

Department and Lands and Forests, Ontario, cooperating; began 1953, indefinite; \$1,000; D. G. Pasko (New York) and N. S. Baldwin (Ontario), Leaders; reports available.

Address inquiries to: D. G. Pasko, as in No. 1 above.

12. Waterchestnut Eradication

The spread of waterchestnut has interfered with the utilization of large areas of water for fishing and other recreation. Priority is being given to eradication of this plant from all areas of new infestation by use of 2,4-D spray from air-propelled boat and hand pulling of lighter infestations.

Eastern and central New York; began April 1955, indefinite; \$5,895; R. T. Harrington, Leader; reports available.

Address inquiries to: John R. Greeley, Conservation Department, Albany, New York.

13. Stream and Lake Development on Public Fishing Areas

This is centered on streams where permanent public fishing rights have been obtained and on lake access areas and is for the purpose of improving fishing and public utilization. It includes marking of signs, development of car parking areas, stream improvement by structures and planting of vegetation.

Statewide; began 1936, continuing; \$200,000; Emerson James, and M. B. Otis, Leader.

Address inquiries to: Emerson James, Port Henry, New York.

14. Investigation of Fish Cultural Techniques

Research on the development of improved apparatus, methods and quality of fish is being handled covering trout and muskellunge culture. The project includes survival studies by creel census and electric shocker, covering brook and brown trout, using fish which have been subjected to special coloration and conditioning experiments as well as control lots. The muskellunge work involves study of rearing to late summer in troughs by feeding minnows.

Rome, Prendergast Point and other hatcheries; began April 1954, indefinite; \$26,269; John R. Greeley, D. C. Haskell, D. G. Pasko and R. G. Norton, Leaders; reports available.

Address inquiries to: John R. Greeley, as in No. 12 above.

15. Reclamation of Gilbert Lake State Park Waters

Gilbert Lake (38 acres) and two smaller bodies of water (14 and 4 acres) are being treated with rotenone under this project previous to stocking.

Began September 1956, closed December 1956; \$561; A. C. Petty, Leader.

Address inquiries to: A. C. Petty, New York State Conservation Department, 21 Lackawanna Avenue, Norwich, New York.

16. Chenango Lake Creel Census

Chenango Lake, treated with rotenone in 1955 and stocked with trout, affords favorable opportunity to test various methods of planting brook and rainbow trout under heavy angling pressure. A virtually complete creel census is obtainable through an angler permit system on this State Park. Tagged trout are used in this study.

Chenango Valley State Park; began April 1956, to close March 1958; \$3,613; A. C. Petty, Leader; reports available.

Address inquiries to: A. C. Petty, as in No. 15 above.

17. Acquisition of Public Fishing Rights on Streams and Lake Access

This represents a continuation of the program of acquiring fishing rights on good trout streams, mainly through perpetual easements and also includes acquisition of access points on lakes by land purchase.

Statewide; began 1935, continuing; \$75,000; C. E. Parker, Leader.

Address inquiries to: C. W. Greene, New York State Conservation Department, Albany, New York.

18. Marine District Inshore Fisheries Investigation

A statistical survey of weakfish, striped bass, fluke and various inshore species. A research vessel (40-foot trawler) will be completed and in use by 1957.

Long Island; began January 1956, indefinite; \$48,713; John C. Poole, Leader.

Address inquiries to: John C. Poole, Conservation Department, 65 West Sunrise Highway, Freeport, L. I., New York.

19. Selective Breeding of Trout for Disease Resistance

This project aims to develop methods for decreasing loss in rearing trout (especially through ulcer disease and furunculosis) by testing of partially disease-resistant strains and selective breeding from the best of such strains.

Cornell University cooperating; Rome Hatchery Laboratory; began April 1952, indefinite; \$17,240; Neil Ehlinger, Leader.

Address inquiries to: R. I. Stevens, Rome Fish Hatchery Laboratory, Rome, New York.

20. Landlocked Salmon Project

This is a combined research and management project to determine practical methods for increasing salmon in lakes and to manage waters where salmon fishing has been built up. The principal species is the landlocked (Atlantic) salmon, but work with red salmon (sockeye) is included.

Statewide; began 1944, indefinite; \$7,000; John R. Greeley, Leader; reports available.

Address inquiries to: John R. Greeley, as in No. 12 above.

21. Experimental Carp Control

To date, practical methods for reducing carp materially have not been devised and research to test the effect of internal poisons looking toward and development of poison bait techniques will be emphasized. Testing and development of electric apparatus, a boat shocker and electric trawl, is in progress in order to improve fish population sampling as a means toward evaluating carp and associated fish. In one lake where a dense population of carp was destroyed by use of rotenone, the regrowth of vegetation is being studied.

Statewide; began June 1953, indefinite; \$35,277; H. A. Loeb, Leader; reports available.

Address inquiries to: H. A. Loeb, 21 Lackawanna Avenue, Norwich, New York.

Cornell University

1. Finger Lakes Investigations: Life History and Management of Rainbow Trout

Intensive study is in progress on the populations of three Finger Lakes that have self-sustaining populations. This work was prompted by lack of success in establishing rainbow trout in Cayuga Lake following repeated hatchery plantings with fish of both domestic and wild parents.

Spawning runs are sampled by electrofishing. After usual processing,

fish are tagged and released. Recovery for tags in both tributaries and lakes permits evaluation of utilization in the two habitats. A creel census by Game Protectors permits estimation of the total stream catch during the opening week of the fishing season. A detailed analysis of the life histories in the different lakes is made from scale analyses. Direct observations were also carried out on habits and growth of fry and parr. A special study, completed in 1956, was concerned with quality of tributary streams for spawning.

New York Conservation Department and U. S. Fish and Wildlife Service cooperating; Keuka, Seneca and Skaneateles Lakes; began March 1946, to close June 1957; \$2,750; Wilbur L. Hartman and Richard W. Hatch, Leaders.

Address inquiries to: Dwight A. Webster, Fernow Hall, Cornell University, Ithaca, New York.

2. Finger Lakes Investigations: Life History and Population Dynamics of Small-mouth Bass in Cayuga Lake, New York

Bass concentrate in a localized area of Cayuga Lake during the fall months. It is possible to accurately census the angling catch here as well as obtain bass for tagging. From data now available the relation of the fall concentration to the lake as a whole can be established and fluctuations in growth and abundance studied. Possible use of stocking hatchery-reared fingerling bass in supplementing the natural population has received attention; over 120,000 marked fish have been planted. Field work in this project has been discontinued and data are being summarized.

New York Conservation Department cooperating; Cayuga Lake, Tompkins, Cayuga, and Seneca Counties; began September 1941, to close 1957; \$1,150; Dwight A. Webster, Leader; reports available.

Address inquiries to: Dwight A. Webster, as in No. 1 above.

3. Finger Lakes Investigations: Management of Lake Trout in Cayuga Lake With Particular Reference to the Role of Hatchery Trout

Principal objectives are concerned with (1) the relative survival of hatchery reared fingerlings and yearling lake trout and (2) the contribution of the hatchery stock to the total population. In addition, the role of lamprey eels, exploitation, and mortality rates are considered.

The annual stocking program consists of 80,000 fall fingerlings (half marked) and 8,000 spring yearlings (all marked). Sampling is primarily in summer using a graded series of gill nets (1½- to 3½-inch stretched mesh), of which a total of 25,000 feet is set according to predetermined design. Additional sampling is carried out on the spawning grounds.

New York Conservation Department cooperating; Cayuga Lake; began August 1946, indefinite; \$5,250; Dwight A. Webster, Leader; reports available.

Address inquiries to: Dwight A. Webster, as in No. 1 above.

4. Population Dynamics of the Common Whitefish (Coregonus clupeaformis) and Round Whitefish (Coregonus quadrilaterle) in Little Moose Lake

The ultimate aim is to improve forage conditions for landlocked salmon (Salmo salar). An attempt is being made to reduce the numbers of adult whitefish of both species to encourage larger populations of young stock (potential salmon food). Control measures consist of trap netting in spawning season. Owing to lack of exploitation, growth in the common whitefish, in particular, has stagnated after sexual maturity and production of young is of a low order. Statistics on growth, age composition, mortality rates and estimated population are taken to assess progress of programs. Complementary data are also available on growth and abundance of brook trout, lake trout, and salmon.

New York Conservation Department cooperating; Herkimer County; began

October 1952, to close 1956; Paul C. Neth, Leader; reports available.

Address inquiries to: Dwight A. Webster, as in No. 1 above.

5. Reduction of Competitors in Ponds by Methods Other Than Total Reclamation

Many potential trout waters are not suited to reclamation by chemical means. Reduction of competition by alternative means (trapping, partial poisoning) is theoretically possible but the practicability needs to be tested from the standpoint of long term benefits. Following initial reduction of the competitors the problems resolve to whether satisfactory trout production can be maintained by periodic control measures and/or biological control by an increased predator population.

Three waters are involved, of 140, 85 and 25 acres. Substantial reductions of the competing species (mostly suckers, Castostomus commersoni) have been attained in two ponds.

New York Conservation Department cooperating; Herkimer and Franklin Counties; began April 1954, indefinite; Dwight A. Webster, Leader.

Address inquiries to: Dwight A. Webster, as in No. 1 above.

6. Production of Brook Trout in Adirondack Ponds

Seven ponds varying in size from 5 to 40 acres are included in the study. Procedure consists of population inventories in the spring and fall designed to yield estimates of total standing crop and mortality rates. Data on yield to angling are also available. Annual plantings of marked fall fingerlings are made to maintain the stock or to assist in evaluating natural production.

New York Conservation Department cooperating; Herkimer and Franklin Counties; began October 1954, to close 1958; Richard W. Hatch and Dwight A. Webster, Leaders; reports available.

Address inquiries to: Dwight A. Webster, as in No. 1 above.

7. Attempted Improvement in Quality of Brook Trout in a Primitive Adirondack Stream

Brook trout in this stream are abundant but grow slowly and rarely exceed 10 inches in length (average 6-7 inches). The upper 10 miles of the stream and its watershed are entirely on private land; fishing is controlled. Apparently a heavy population of competing native species (suckers and minnow) is present. These have been eliminated in two headwater ponds from which they were migrating downstream. Four two-way fish traps are operated on the stream system for the removal of competing species and study of movements of all species. Larger (10-13 inches) brook trout have been transferred from the reclaimed headwater ponds in an attempt to provide some measure of biological control. Scale samples, lengths and weights are taken annually from a sample of the trout population and are used for judging progress of work. Inventory by electrofishing of the fish populations is planned. Additional measures for improving size of trout population consist of partial chemical eradication of competing species in certain sections of the stream and artificial fertilization.

New York Conservation Department cooperating; Franklin County; began October 1952, indefinite; Dwight A. Webster, Leader.

Address inquiries to: Dwight A. Webster, as in No. 1 above.

8. Life History and Management of Landlocked Salmon (Salmo salar) in Little Moose Lake

The small but self-perpetuated population of salmon in Little Moose Lake has been markedly increased by lake plantings of hatchery reared yearling and two-year-old salmon. Growth and maturity pattern in these two groups shows divergence; these are being studied in relation to the natural life history in which

parr migrate to the lake from the outlet one or two years following hatching. The possibilities of increased natural production of parr by improvement of the outlet spawning area and by planting of eyed eggs or advanced fry are also being studied.

New York Conservation Department cooperating; Herkimer County; began April 1951, indefinite; Dwight A. Webster, Leader.

Address inquiries to: Dwight A. Webster, As in No. 1 above.

9. Fisheries Management in New York Lakes and Ponds

This project is designed to develop management methods which will provide maximum sustained yields of fish in farm ponds and lakes of New York State.

Farm pond investigations are concerned with trout ponds, ponds stocked with warm-water game and pan fish, and bait minnow ponds. Work on trout ponds includes evaluations of experimental stocking rates of brook and rainbow trout, determinations of growth, angling yield and natural mortality, and investigations of the suitability of various trout hybrids and late-maturing strains. Research on warm-water ponds is concerned with evaluations of various stocking ratios of largemouth bass and bluegill sunfish, of ponds stocked with bass fingerlings and adult golden shiners, and of ponds stocked with channel catfish alone. Objectives of the minnow pond studies are to determine production, growth, and optimum stocking rates and stocking methods for the golden shiner, white sucker, fathead minnow, and silver y minnow.

Lake studies, which were begun in April 1956, with preliminary investigations on Oneida Lake, New York, are designed to formulate management recommendations for warm-water game species on the basis of information on fish populations obtained from creel census, tagging, and sampling by means of trap nets, gill nets, trawls, and electrical fishing devices.

New York Conservation Department cooperating; Central New York; began April 1952, to close March 1959; \$40,000; Alfred W. Eipper, Leader; reports available.

Address inquiries to: Alfred W. Eipper, Fernow Hall, Cornell University, Ithaca, New York.

10. Population Structure of the Bluefish, *Pomatomus saltatrix*

The objective is to determine if the Atlantic Coast bluefish population is one large intermingling unit. Specimens have been obtained of young and adults from a wide range along the coast and are now being studied. Fin rays, lateral line scales, and other meristic characters are being used in the preliminary phases.

Sport Fishing Institute, U. S. Fish and Wildlife Service, Institute of Fisheries Research of the University of North Carolina, Massachusetts Department of Natural Resources, New Jersey Department of Conservation and Economic Development, and Rutgers University cooperating; Cornell University; began September 1956, indefinite; \$1,800; Edward C. Raney and William Albert Lund, Jr., Leaders.

Address inquiries to: Edward C. Raney, Department of Conservation, Fernow Hall, Cornell University, Ithaca, New York.

11. Population Structure of the Atlantic Coast Striped Bass

The object is to determine the population units of the Atlantic Coast striped bass.

U. S. Fish and Wildlife Service and Sport Fishing Institute cooperating; Cornell University; began September 1952, indefinite; \$2,400; Edward C. Raney, Leader; reports available.

Address inquiries to: Edward C. Raney, as in No. 10 above.

12. Atlantic States Cooperative Striped Bass Program

The several states are investigating local problems which involve inventory, catch and effort, location of spawning grounds, movements of local populations, physiology, growth and early life history, ecology, survival of young, sex ratios, food, populations estimates, effects of pollution, etc. In the coordinator's laboratory, studies of racial structure, especially of the subpopulations in Chesapeake Bay, using fin ray, scale, gill raker counts, morphometric characters, and scale characters, continue. General studies of migration as determined by tagging are also under way.

U. S. Fish and Wildlife Service, Sport Fishing Institute, U. S. Public Health Service, U. S. Corps of Engineers, and conservation agencies in Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Maryland, Virginia, North Carolina, and South Carolina, also Maryland, North Carolina and Rutgers Universities, as well as other organizations cooperating; Atlantic Coast states; began September 1952, indefinite; \$90,000; Edward C. Raney, Leader; reports available.

Address inquiries to: Edward C. Raney, as in No. 10 above.

U. S. Fish and Wildlife Service, Branch of Fishery Biology

1. Vitamin Requirement of Trout

The objectives are: (1) To determine the vitamin requirements of trout and the symptoms of deficiencies by means of vitamin test diets and micro-biological assays (2) to improve the health, increase the rate of growth, and lower the cost of producing hatchery trout.

New York Conservation Department and Cornell University cooperating; Cortland; began April 1940, to close January 1957; Arthur M. Phillips, Jr., Leader; reports available.

Address inquiries to: Arthur M. Phillips, Jr., U. S. Fish and Wildlife Service, Cortland, New York.

2. Development of Practical Diets for Trout

The objectives are: (1) To determine the value of various dietary mixtures in terms of growth, cost of production and mortality of the fish. (2) To determine the effect of dietary mixtures upon the body chemistry of the trout.

New York Conservation Department and Cornell University cooperating; Cortland; began April 1935, continuing; Arthur M. Phillips, Jr., Leader; reports available.

Address inquiries to: Arthur M. Phillips, Jr., as in No. 1 above.

3. Use of Radio-active Isotopes in Trout Nutrition Studies

The objectives are to study the absorption, utilization, and retention of minerals dissolved in the water and/or present in the diet and their role in trout nutrition and physiology.

New York Conservation Department and Cornell University cooperating; Cortland, began July 1951, continuing; Henry A. Podoliak, Leader; reports available.

Address inquiries to: Arthur M. Phillips, Jr., as in No. 1 above.

4. The Chemical Comparison of Hatchery and Wild Fish Food

The objectives are to chemically compare hatchery and wild food and trout reared upon each type. From this information the effectiveness of hatchery food in terms of natural food is to be measured. From these data an attempt will be made to improve hatchery diets.

New York Conservation Department and Cornell University cooperating;

## NEW YORK (Cont.)

Cortland; began April 1953, continuing; Arthur M. Phillips, Jr., Leader; reports available.

Address inquiries to: Arthur M. Phillips, Jr., as in No. 1 above.

### 5. Chemical Analyses of Trout Blood

The objectives are to determine the organic and inorganic composition of fish blood and the factors that alter the chemical composition. These data will furnish valuable information for the study of fish disease and their control. Such data will also provide a measure of the effect of diet, physical environmental factors, and disease upon the physiology of trout.

New York Conservation Department and Cornell University cooperating; Cortland; began July 1956, to close December 1959; Arthur M. Phillips, Jr., Leader; reports available.

Address inquiries to: Arthur M. Phillips, Jr., as in No. 1 above.

### 6. The Chemical Embryology of Trout Eggs and Sac Fry

The objectives are: (1) To determine the chemical changes of trout eggs and sac fry during development and correlate these changes with physical and dietary factors. (2) To improve the quality of hatchery trout eggs by applying the findings.

New York Conservation Department and Cornell University cooperating; Cortland; began October 1955, to close December 1958; Arthur M. Phillips, Jr., Leader; reports available.

Address inquiries to: Arthur M. Phillips, Jr., as in No. 1 above.

### 7. Cortland Within Service Training School

This project provides basic and applied information to fish-cultural personnel in an attempt to increase the efficiency of hatchery operation. The training is composed of lectures, laboratory periods, and practice in hatchery management.

New York Conservation Department and Cornell University cooperating; Cortland; began September 1944, continuing; Arthur M. Phillips, Jr., Leader.

Address inquiries to: Arthur M. Phillips, Jr., as in No. 1 above.

## NORTH CAROLINA

### Wildlife Resources Commission

#### 1. High Rock Lake Fish Management Investigations

This project is designed to obtain fish management information on large power reservoirs at low altitude, and 17,000-acre High Rock Lake in particular. Fish sampling stations were set up at which trammel and gill nets were operated and all catches carefully recorded. Rotenone samples were taken for additional data. Water analysis samples were taken at weekly intervals during the summer months and monthly during the winter. An intensive creel census provides catch information and harvest data. A final report of field work is now in progress.

Began July 1955, to close June 1957; \$15,000; James Messer, Leader.

Address inquiries to: L. B. Tebo, Jr., Box 2919, Raleigh, North Carolina.

#### 2. Acquisition and Development of Access Areas

This project is designed to acquire and develop land on important public fishing waters which are now or which may become inaccessible to fishermen. Often times leases from power companies, aluminum companies, Army Engineers or T. V. A. provide areas which are inexpensively developed. Facilities include a boat ramp and car and trailer parking at no charge.

NORTH CAROLINA (Cont.)

Began July 1952, to close June 1960; \$16,000; William Kinsey, Leader.  
Address inquiries to: Floyd Williamson, Box 2919, Raleigh, North Carolina.

3. Cold Water Fish Management Investigations

This project is designed to obtain data on cold water streams, lakes, and impoundments for use in planning a sound fish management program. Trout, smallmouth bass, and walleyes will be studied particularly including their relative abundance, habitat requirements, and movements. On cold water streams, trout population, catch, and survival will be studied. On controlled Wildlife Management Areas, precise catch records can be kept by operating creel census stations at the only points of access. Survival and catch of stocked trout are measured. Sound trout and general cold-water management practices result.

Western North Carolina; began July 1955, to close June 1962; \$40,000; L. B. Tebo, Jr., Leader; reports available.

Address inquiries to: L. B. Tebo, Jr., Box 2919, Raleigh, North Carolina.

4. Small Lake Management Investigations

This project is designed to obtain fish management data on lakes from 10 to 30 acres in size containing primarily bass and bluegill combinations. Four lakes have been selected in a Wildlife Management Area located within 15 miles of each other and which can be controlled. Experimentation will include water draw-downs, stocking ratio variations and vegetation study. Creel censuses will be conducted to measure the effectiveness of the experimental practices and complete population checks can be made using drain kettles and holding troughs below each lake.

Hoffman; began July 1954, to close June 1960; \$18,500; Robert Humphries, Leader; reports available.

Address inquiries to: Robert Humphries, Sandhills Wildlife Management Area, Hoffman, North Carolina.

5. Warm Water Fish Management Investigations

This project is designed to obtain data on major warm water lakes and reservoirs which will be helpful in devising fish management plans. It includes the selection of the most important pieces of water on a district basis, determination of relative fish populations, species composition, water analysis, vegetation observation and general survey of the water selected. Fish sampling gear is standardized to experimental gill nets, nylon trammel nets, and rotenone samples. Annual fish samples will be taken for comparative status of populations.

Piedmont and eastern North Carolina; began July 1955, to close June 1960; \$70,000; L. B. Tebo, Jr., Leader; reports available.

Address inquiries to: D. F. Raver, Box 2919, Raleigh, North Carolina.

North Carolina State College

1. Fish Culture in Farm Ponds

The objectives are to develop a hybrid sunfish suitable for farm ponds, to determine optimum stocking procedures using hybrid sunfish, and to study the effect of fertilization on hybrid sunfish growth. Attempts will be made to obtain offspring from crosses of different species of sunfish in experimental ponds. It is hoped that sufficient numbers will result to determine optimum stocking ratios with largemouth bass in farm ponds either with F<sub>1</sub> offspring or with adults of the different species that will produce offspring in farm ponds.

Raleigh and Fayetteville; began July 1956, to close July 1961; \$10,000; Edward M. Lowry, Leader.

Address inquiries to: Edward M. Lowry, Box 5215 - Zoology, State College Station, Raleigh, North Carolina.

## NORTH DAKOTA

### Game and Fish Department

#### 1. Statewide Fisheries Investigations

A program to map the lakes of North Dakota as a basis for fisheries management. Chemical and biological investigations are carried out on natural lakes, artificial reservoirs, and stock ponds with emphasis on factors responsible for existing populations. This includes evaluation of hatchery plantings. Determination of needs for establishment of improved fisheries is also considered.

Statewide; began July 1953, continuing; \$18,250; Dale L. Henegar, Leader; reports available.

Address inquiries to: Dale L. Henegar, North Dakota Game and Fish Department, Bismarck, North Dakota.

#### 2. Garrison and Snake Creek Fisheries Investigations

This is a program to carry out intensive investigations in the Garrison and Snake Creek Reservoirs. The information so gathered will serve as the basis for future management of both reservoirs. Because neither of the reservoirs will attain maximum pool levels during the duration of the project it is contemplated that additional work will be carried out on contributing areas in the two watersheds.

Began July 1953, continuing; \$9,500; Louis Carufel, Leader; reports available.

Address inquiries to: Dale L. Henegar, as in No. 1 above.

### North Dakota Agricultural College

#### 1. Life Cycle Studies of a Calanoid Copepod Population (Diaptomus siciloides)

This copepod population is being studied to obtain information on the following: Time of egg hatching in spring; duration of each instar; duration of each generation; number of generations; time of egg production in each generation; number of eggs, total and per female; reproductive activities: Time, intensity, duration; growth, as determined by length measurements and weight of each instar; mortality; grazing of the phytoplankton where this is discernible; to determine whether quantity of food is limiting at any time; cell volume of the phytoplankton, number and kind of algae; chlorophyll content and carotinoids; photosynthesis, to determine basic productivity directly. Computation of the photosynthetic efficiency of the algal population. The following environmental factors are measured at the same time for the entire season: temperature, air and five depths in the lake; transparency (Secchi disc); phosphate, as free  $\text{PO}_4$ ; alkalinity; and pH.

National Science Foundation cooperating; Detroit Lakes area, Becker County, Minnesota; began April 1955, to close July 1957; \$2,850; Gabriel W. Comita, Leader.

Address inquiries to: Gabriel W. Comita, Department of Zoology, North Dakota Agricultural College, Fargo, North Dakota.

## OHIO

### Department of Natural Resources

#### 1. Anglers' Facilities

This project involves construction of parking lots, boat launching ramps, sanitary facilities, wells, access roads, and fishing piers.

OHIO (Cont.)

Statewide; closed December 1956; Clarence F. Clark, Mark O. White, John D. Walker, Ray H. Riethmiller, Daniel Armbruster and Robert Cummins, Leaders; reports available.

Address inquiries to: E. L. Wickliff, 1500 Dublin Road, Columbus 12, Ohio.

2. Aquatic Vegetation Control

Aquatic vegetation is controlled by chemical treatment and mechanical cutters. Experimental use of various types of chemicals and an evaluation of them is under way.

Statewide; continuing; Clarence F. Clark, John D. Walker, Ray H. Reithmiller, Mark O. White and Daniel C. Armbruster, Leaders; reports available.

Address inquiries to: E. L. Wickliff, as in No. 1 above.

3. Statewide Inventories

All major public fishing waters were inventoried to check on production and standing populations. The results are closely correlated with creel census to determine the harvest.

Statewide; continuing; Robert Cummins, Clarence F. Clark, Daniel C. Armbruster, Mark O. White, Ray H. Riethmiller, and John D. Walker, Leaders; reports available.

Address inquiries to: E. L. Wickliff, as in No. 1 above.

4. Planned Population Balance and Control Program

One part of the planned population balance and control program consists of corrective stocking. Several large areas were stocked with large predator species, namely, walleye pike, northern pike, and muskellunge, in an attempt to improve the quality of certain pan fishes. Largemouth bass and white bass were stocked in certain problem lakes with the same idea in mind.

Statewide; continuing; Clarence F. Clark, Daniel C. Armbruster, Mark O. White, Ray H. Riethmiller and John D. Walker, Leaders; reports available.

Address inquiries to: E. L. Wickliff, as in No. 1 above.

5. New Methods of Catching Fish

New methods of catching fish are constantly being tried. Wire traps of various sizes and designs were fished experimentally in two different rivers. The results will be summarized. Trot lines and float lines were fished experimentally in Mosquito Creek Reservoir and Berlin Reservoir, and further study is needed before any real evaluation can be made. Trawls have been used in several inland lakes and rivers to find out how effective such a tool might be in our fish management work, especially as to sampling year classes and possible removal.

U. S. Army Engineers cooperating; statewide; continuing; Robert Cummins, Clarence F. Clark, Daniel C. Armbruster, Mark O. White, Ray H. Riethmiller, and John D. Walker, Leaders.

Address inquiries to: E. L. Wickliff, as in No. 1 above.

6. Farm Ponds

Farm pond experimental stocking of bluegills and largemouth bass has been carried on for the past three years in 12 one-acre ponds located at the United States Fish Cultural Station near Buckeye Lake. The 3-year study will give the results of basic stocking ratios as they apply generally to Ohio's ponds and other small impoundments.

U. S. Fish and Wildlife Service and Denison University cooperating; U. S. Fish Cultural Station, Hebron; began 1953, continuing; Ray H. Riethmiller, Leader; reports available.

Address inquiries to: E. L. Wickliff, as in No. 1 above.

7. Lake Erie Investigations

Lake Erie activities gave special attention to trap net selectivity for commercial fisheries. The work is being evaluated at the present time. Trawls of various sizes were used in Sandusky Bay and Lake Erie. This study is set up to sample the various year classes of the major fishes, and also to determine the commercial aspect of trawls. Sea lamprey investigations were conducted to determine spawning runs, location of young, and survey of damage to the Lake Erie fishery.

U. S. Fish and Wildlife Service, Province of Ontario, States of New York, Pennsylvania and Michigan cooperating; Lake Erie; continuing; Robert Cummins, Leader; reports available.

Address inquiries to: E. L. Wickliff, as in No. 1 above.

8. New Lakes

This is the primary method whereby additional waters and fishing opportunity are made available to Ohio's steadily growing number of fishermen.

Statewide; continuing; Clarence F. Clark, Daniel C. Armbruster, Mark O. White, Ray H. Riethmiller, and John D. Walker, Leaders; reports available.

Address inquiries to: E. L. Wickliff, as in No. 1 above.

9. Lake and Pond Fertilization

Fertilization of the Mt. Gilead Lakes for the past two years has resulted in considerable success in controlling submerged vegetation. Bass and bluegill fishing has continued to improve. Additional fertilization and evaluation will be made.

Statewide; continuing; Clarence F. Clark, Daniel C. Armbruster, Mark O. White, Ray H. Riethmiller, and John D. Walker, Leaders; reports available.

Address inquiries to: E. L. Wickliff, as in No. 1 above.

10. Fish Removal

The greatest removal effort was made in Guilford Lake, where in 1954 there were 63.4 pounds of fish removed per acre. In 1955 a total of 134.2 pounds per acre were removed. Those species taken from this 390-acre body of water consisted of sunfish, bluegills, crappies, shad, bullheads, suckers, and other rough species. An evaluation was conducted during 1956.

Statewide; continuing; Clarence Clark, Daniel C. Armbruster, John D. Walker, Ray H. Riethmiller and Mark O. White, Leaders; reports available.

Address inquiries to: E. L. Wickliff, as in No. 1 above.

11. Zimmerman Marsh Wildlife Area

The objectives are to acquire the Zimmerman Marsh and to develop it as a public hunting area and access site for fisherman.

Ottawa County; began August 1956, closed November 1956; \$8,297; Floyd B. Chapman, Leader.

Address inquiries to: E. L. Wickliff, as in No. 1 above.

12. Construction of Clark County Fishing Lake

The purpose is to construct a 104-acre fishing lake.

Springfield; began August 1956, to close December 1958; \$145,000; Floyd B. Chapman, Leader.

Address inquiries to: E. L. Wickliff, as in No. 1 above.

13. Construction of Monroe County Fishing Lake

The purpose is to construct a 45-acre fishing lake.

Malaga; began February 1956, to close January 1957; \$183,000; Floyd B.

Chapman, Leader.

Address inquiries to: E. L. Wickliff, as in No. 1 above.

14. Investigation of Lake and Stream Fisherman Access Sites for Acquisition and Development

The objectives are: (1) To obtain tax data, assemble information on feasibility, ownership, and suggest a tentative development plan for fisherman access sites suggested for purchase by Division field personnel; and (2) to obtain tax and ownership information, make drainage area studies, suggest tentative management plan, and make recommendations for purchase of lake sites submitted by Division field personnel.

Statewide; began March 1956, to close February 1957; \$7,250; Osmon J. Ramsey and T. Theodore Ramsey, Leaders; reports available.

Address inquiries to: E. L. Wickliff, as in No. 1 above.

15. Investigation of the Effects of Land Use Improvements on Stream Fisheries

The objectives are: (1) To make a qualitative determination of the physical problems of runoff, uneven stream flow, and siltation; (2) to determine corrective land use techniques that may be used to curb runoff, stabilize stream flow, and reduce siltation; and (3) to determine the biological conditions (fish populations, status of fish foods, etc.) in the streams before, during and after correction of present unsuitable stream conditions.

Ohio Division of Water and U. S. Geological Survey cooperating; headwaters of the Little Miami River and Massie Creek in Clark and Greene Counties; began May 1952, indefinite; \$26,000; Edward Brown, Leader; reports available.

Address inquiries to: E. L. Wickliff, as in No. 1 above.

16. Strip Mine Ponds

In strip mining coal under private mineral reservations on National Forest land funds are collected from the coal companies to rehabilitate the surface. As part of this restoration program forest officers secure the cooperation of the coal companies in developing small lakes which can be used for fishing, wildlife ponds, and general recreation. Special dikes are required to create the ponds, and the shoreline must be backsloped in such a manner as to cover waste coal, thus eliminating the danger of acid waters and permitting seeding of the shorelines.

The Ohio Division of Wildlife cooperates in planning this rehabilitation work, periodically tests the acidity of the water, and stocks fish when conditions become suitable.

Lawrence, Hocking and Perry Counties; began 1936, continuing; District Ranger, Leader.

Address inquiries to: District Ranger, U. S. Forest Service, Athens or Ironton, Ohio.

Ohio State University

1. Abatement of Mine Acid Wastes

The objective of this project is the development of techniques to prohibit the formation of acid wastes in abandoned underground coal mines and in spoil from mining operations. Two approaches to the problem are involved. (1) The study of bacterial organisms which might be utilized in prohibiting acid formation. (2) The devising of engineering structures and techniques designed to eliminate the conditions which make acid formation possible in mines and spoil material.

Ohio Pollution Control Board, Public Health Service, Natural Resources

## OHIO (Cont. )

Institute, cooperating; Ohio State University and Raccoon Creek Watershed of southern Ohio; began June 1956, indefinite; \$30,000; C. I. Randles (bacteriological phase) and Robert Green (engineering phase), Leaders.

Address inquiries to: Charles A. Dambach, Director, Natural Resources Institute, 102 H and F Building, Ohio State University, Columbus 10, Ohio.

### 2. Toxicity of Six Chlorinated Organic Insecticides to Bluegills

This project involves the determination of the toxicity of certain insecticides to pond fishes in Ohio waters.

Department of Natural Resources cooperating; Franz Theodore Stone Laboratory, Put-in-Bay; began April 1956, closed October 1956; Loren Moseley, Leader; reports available.

Address inquiries to: Loren Moseley, Fish Management Section, Ohio Division of Wildlife, 1500 Dublin Road, Columbus 12, Ohio.

### 3. Basic Studies in Fisheries Biology

This project consists of basic studies concerning the biology of sport and commercial fishes of the waters of Lake Erie. Special segments of this investigation include: (1) Certain aspects of plankton productivity in the western Lake Erie region, C. C. Davis, Leader, Western Reserve University. (2) A preliminary report on a study of aquatic nematodes in western Lake Erie. John L. Crites, Ohio State University. (3) A quantitative study of photosynthetic bacteria in Lake Erie. Phillip Halicki, Bowling Green State University. (4) A resurvey of the incidence of parasitism in fishes of Ohio waters of Lake Erie. William Coil, Ohio State University.

Franz Theodore Stone Laboratory, Put-in-Bay; began June 1956, closed October 1956; \$4,500; reports available.

Address inquiries to: 1. Dr. C. C. Davis, Western Reserve University, Cleveland, Ohio. 2. Dr. John L. Crites, Department of Zoology, Ohio State University, Columbus 10, Ohio. 3. Mr. Phillip Halicki, Department of Biology, Bowling Green State University, Bowling Green, Ohio. 4. Dr. William Coil, Department of Zoology, University of Nebraska, Lincoln, Nebraska.

## U. S. Public Health Service

### 1. Definition of Water Quality Requirements for the Protection of Aquatic Life.

This project consists of: (1) Basic studies on the toxicology and environmental requirements of aquatic life; (2) development of procedures for estimating the effects of long-time exposures by means of short-term bio-assays; (3) relationship of pH, alkalinity, hardness, and other water quality characteristics to the toxicity of metals and other chemicals; and (4) studies of the toxicity of selected industrial effluents and other materials to fishes.

Oregon State College cooperating; Cincinnati, Ohio, and Corvallis, Oregon; continuing; \$50,000; Clarence M. Tarzwell for the Public Health Service and R. E. Dimick for Oregon State College, Leaders; reports available.

Address inquiries to: Clarence M. Tarzwell, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio.

## OKLAHOMA

### Game and Fish Department

#### 1. Fisheries Investigations of Fort Gibson and Tenkiller Reservoirs

A creel census is conducted to establish the annual angler harvest in

numbers of fish caught and pounds per acre yield. Fish population sampling with gill nets is carried on to aid the creel census analysis and provide material for making an age and growth analysis. Rotenone sampling evaluates success in reproduction and survival of young.

Began November 1955, to close October 1956; \$23,000; Alfred Houser, Leader; reports available.

Address inquiries to: State Game and Fish Department, Room 118, Capitol, Oklahoma City, Oklahoma.

2. Lake Watonga

The objective is to construct a 65 surface-acre lake adjoining Roman Nose State Park.

Blaine County; began July 1955, closed September 1956; \$66,000; Buell Atkins, Leader.

Address inquiries to: Buell Atkins, State Game and Fish Department, Capitol Building, Oklahoma City, Oklahoma.

3. Summer Survey Project

Over 30 small lakes, ponds, and cove areas of large impoundments were surveyed during the summer of 1956. In most cases the surveys included the marking of fish by fin clipping, traps and seines being used to capture fish for marking. Fish were marked in an effort to gauge the degree of recovery after rotenoning and to test accuracy of methods used in determining standing crops in various bodies of water. In some cases this system of marking was also employed to evaluate effects of management practices on lakes under direct management of Oklahoma Game and Fish Department. Age and growth studies were also conducted in conjunction with the marking and rotenoning project.

Southern, central and northeastern Oklahoma; began June 1956, to close April 1957; \$6,000; Robert M. Jenkins, Leader; reports available.

Address inquiries to: Robert M. Jenkins, Fisheries Research Laboratory, North Campus, Box 14, Norman, Oklahoma.

4. Pre-impoundment Survey of the Verdigris River

The intention of this project was to make a detailed study of the fisheries resources of the Verdigris River prior to construction and impoundment of Oologah Reservoir. The project included sampling by netting, trapping, seining, and rotenoning.

Corps of Army Engineers cooperating; Nowata and Rogers Counties; began June 1956, to close January 1957; \$4,500; Joe C. Finnell, Leader; reports available.

Address inquiries to: Robert M. Jenkins, as in No. 3 above.

5. Gypsum Treatment of Waurika Lake

The objective of this project is to reduce the turbidity of a 60 surface-acre lake by the use of agricultural gypsum. Applications of the 100 tons of gypsum used were made on the watershed and to the lake proper.

Jefferson County; began April 1956, to close January 1957; \$1,000; Tom Avant, Leader; reports available.

Address inquiries to: Robert M. Jenkins, as in No. 3 above.

U. S. Fish and Wildlife Service, Branch of Game-fish and Hatcheries

1. Sealed Container Shipment of Warm Water Species

To provide better service and to reduce costs, small lot shipment via

express or parcel post, utilizing plastic bags and corrugated boxes is under development. A number of test shipments have been made. The method utilizes a small amount of water, several ounces of fish per container, hypnotic type drugs, and oxygen.

Tishomingo, Oklahoma; began July 1956, to close December 1957; \$500; C. E. Cozord, Leader.

Address inquiries to: Regional Director, U. S. Fish and Wildlife Service, P. O. Box 1306, Albuquerque, New Mexico.

## OREGON

### Fish Commission

#### 1. Razor Clam Management Studies

The objective is to determine maximum annual yield from razor clam stocks. The project involves extensive sampling of sport and commercial catches to determine digger success and age composition of sport and commercial catches. Methods of relating success of spawning to abundance of year-class as it progresses through the fishery are under study.

Northern coastal beaches; began 1947, continuing; \$8,500; Robert J. Ayers, Leader; reports available.

Address inquiries to: Robert J. Ayers, 1236 West Marine Drive, Astoria, Oregon.

#### 2. Coastal Salmon Studies

General survey work to locate and correct factors that limit salmon production in Oregon coastal streams. Studies involve enumeration of certain runs in selected areas, collection of data on gill net fisheries in streams that are open to fishing, and relationships between spawning escapements and recruitment.

One aspect of work involves analysis of stomach contents of fingerling silver salmon to determine if food is a limiting factor in natural production of this species in Oregon. Ecological studies are also conducted at a small weir on a tributary of a representative stream.

Coastal streams; began 1946, continuing; \$30,000; Raymond A. Willis, Leader; reports available.

Address inquiries to: Raymond A. Willis, Fish Commission Research Laboratory, Box 226, Bay City, Oregon.

#### 3. Hatchery Biology Studies

Experimental diets are being tested to find the most economical, nutritious diet for rearing salmon and steelhead trout in hatcheries. Major emphasis has been put on use of marine scrap fishes and fish processing plant wastes. Work is currently being done to control rancidity in prepared meals. One diet is now being tested at production level.

In addition to diet studies, investigations of diseases of salmon and steelhead raised in hatcheries are being conducted. Primary attention has been given to kidney disease and tuberculosis. Limited work has been done on testing the toxicity of various algacides in regard to salmon and steelhead fry and fingerlings.

U. S. Army Corps of Engineers and Oregon State College cooperating; Astoria, Sandy and Oakridge; began 1947, continuing; Thomas B. McKee, Leader; reports available.

Address inquiries to: Thomas B. McKee, Fish Commission Research Laboratory, Route 1, Box 263B, Sandy, Oregon.

4. Enumeration of Runs of Salmonid Fishes in Snake River

This study was undertaken to collect data on the time of migration and numerical abundance of Snake River salmon and steelhead runs.

Barrel-shaped fyke nets, as large as 18 feet long and 10 feet in diameter were used to tag fish in the Snake River just below and above Lewiston, Idaho. The nets were operated in two batteries, a lower one for tagging and an upper battery for recovery of tagged fish.

U. S. Army Corps of Engineers and Idaho Department of Fish and Game cooperating; Lower Snake River; began 1953, to close July 1957; Edwin K. Holmberg, Leader; reports available.

Address inquiries to: Edwin K. Holmberg, Fish Commission Research Laboratory, Route 1, Box 31A, Clackamas, Oregon.

5. Downstream Migrant Salmonid Collecting at High Dams

Fingerling collection by creation of surface currents will be tested and evaluated at Lookout Point Reservoir on the Middle Willamette River during the spring of 1957. The reservoir is typified by fluctuating water levels and little or no spill.

A large pump mounted on a floating platform and capable of discharging 50 cubic feet per second will be used to produce currents at various locations along the spillway of the dam. Fish attracted to the device will be retained by a trap mounted on the platform. Fingerlings now being held at a nearby hatchery will be released in the reservoir when testing begins.

U. S. Army Corps of Engineers cooperating; Lookout Point Reservoir; begins spring 1957, indefinite; \$73,000; Edwin K. Holmberg, Leader; reports available.

Address inquiries to: Edwin K. Holmberg, as in No. 4 above.

6. Estimation of Adult Chinook Salmon Mortality at Bonneville Dam

This study is an attempt to determine the number of adult Chinook salmon killed in the vicinity of Bonneville Dam on the Columbia River.

Dead salmon that had been kept in cold storage from the preceding spawning season were thawed, tagged, and introduced into the Columbia River at various locations where mortalities might be expected to occur. A systematic search of areas below Bonneville Dam was made to recover tagged carcasses intermingled with untagged carcasses.

U. S. Fish and Wildlife Service cooperating; Columbia River; began April 1955, closed November 1956; Theodore R. Merrell, Leader.

Address inquiries to: Melvin D. Collins, Fish Commission Research Laboratory, Route 1, Box 31A, Clackamas, Oregon.

7. Study of Effects of the Dalles Dam on Migration of Anadromous Fishes

Salmonid fishes are being tagged at Bonneville Dam and released above the dam to proceed upstream. Recovery of tagged fish at McNary Dam up-river provides estimate of migration rate between two structures. Complete closure of river at the Dalles Dam occurred in the fall of 1956. Tagging will be repeated in 1957 for comparison of migration rate before and after effects of the Dalles Dam might be felt.

Fish for tagging were captured at upstream exit of Washington shore fishway at Bonneville in a specially designed floating trap. Approximately 9,000 salmonids were tagged during field work in 1956.

U. S. Army Corps of Engineers cooperating; Columbia River; began May 1956, to close 1957; Theodore R. Merrell, Leader.

Address inquiries to: Melvin D. Collins, as in No. 6 above.

8. Suttle Lake Blueback (Sockeye) Salmon Fingerling Survival Study

This project is being conducted in conjunction with attempts to establish a blueback salmon run in Suttle Lake which is connected to the Columbia River by the Deschutes System. Liberations of blueback fingerlings have been made in Suttle Lake since 1952 by the Fish Commission of Oregon.

The survival of fingerlings planted in the fall and leaving the lake the following spring is measured at a counting station at the outlet of the lake.

Since 1954, all bluebacks released in Suttle Lake have been fin-marked. Sport fishery surveys have been made at the lake to determine the contribution of marked bluebacks to the sport fishery.

U. S. Fish and Wildlife Service cooperating; Suttle Lake; began 1954, continuing; Robert L. Rulifson, Leader; reports available.

Address inquiries to: Robert L. Rulifson, Fish Commission Research Laboratory, Routel, Box 31A, Clackamas, Oregon.

9. Gnat Creek Weir Studies

Gnat Creek weir, with downstream and upstream fish counting facilities, was completed in 1955 on a small tributary of the Columbia River to provide detailed information on the ecology of salmon and steelhead.

Fin-marking experiments have been undertaken to determine the best time for releasing hatchery-reared fall chinook salmon. A second study will be started this winter to compare survival to maturity of hatchery-reared and stream-reared silver salmon fingerlings.

Similar weir studies at another station on Spring Creek, a tributary of an Oregon coastal stream, have been conducted for several years by the Fish Commission. Detailed information on the stream survival of silver salmon to migrant size has been obtained at the Spring Creek weir.

U. S. Fish and Wildlife Service cooperating; twenty miles east of Astoria on Gnat Creek; began September 1955, continuing; \$10,000; Ernest R. Jeffries, Leader; reports available.

Address inquiries to: Ernest R. Jeffries, Fish Commission Research Laboratory, Route 1, Box 31A, Clackamas, Oregon.

10. Hydrographic Studies of Oregon Bays

In view of proposed pulp plants on certain Oregon bays, these studies have been conducted to determine the flushing action of the bays affected. Data collected during the studies are helpful in determining how long pollutants dumped into a particular bay at various points would be retained.

Office of Naval Research, Oregon State College cooperating; Coastal bays of Oregon; began June 1955, continuing; Lowell D. Marriage, Leader; reports available.

Address inquiries to: Lowell D. Marriage, Fish Commission of Oregon, 301 State Office Building, Portland 1, Oregon.

Game Commission

1. Fish Lake

The objective of the acquisition of Fish Lake comprising approximately 30 surface-acres was to provide for active fishery management and free public use.

Harney County; began September 1956, closed November 1956; \$12,000; Clifton Lemons, Leader.

Address inquiries to: A. V. Meyers, Federal Aid Coordinator, Oregon State Game Commission, P. O. Box 4136, Portland, Oregon.

2. Development of Public Access Facilities

The objective of the development of public use facilities for access purposes is to provide adequate parking areas with access roads if needed and boat launching facilities. Trail construction and fencing are often a part of access projects. Further recreational development is accomplished in desirable areas by local county governments.

Statewide; began January 1953, indefinite; \$10,267; D. L. Eastman and Clifton Lemons, Leaders; reports available.

Address inquiries to: A. V. Meyers, as in No. 1 above.

3. South Umpqua Falls Fishway

The objective of this project was the construction of a suitable fish ladder over a nearly impassable barrier to fish migration in the South Umpqua River.

Began February 1954, closed December 1955; \$2,500; Ray Kincaid, Leader.

Address inquiries to: George J. Kernan, Chief Engineer, Oregon State Game Commission, P. O. Box 4136, Portland, Oregon.

4. Lake Rehabilitation Efforts

The objective of lake rehabilitation work is the removal of an existing fish population through the use of rotenone and the subsequent stocking with desirable species of game fish. Partial or complete rehabilitation work is constantly going on in small lakes but several large bodies of water have recently received complete chemical treatment, namely: Lake of the Woods, Thompson Valley Reservoir, Devils Lake, Malheur Reservoir, Beulah Reservoir, and Warm Springs Reservoir.

Statewide; began January 1941, indefinite; \$121,500; John B. Dimick, Leader; reports available.

Address inquiries to: H. J. Rayner, Chief of Fisheries, Oregon State Game Commission, P. O. Box 4136, Portland, Oregon.

5. Acquisition of Public Fishing Access Areas

The objective is to provide perpetual free public access across and along river frontage lands in key fishing areas through purchase, easement or agreement.

Counties, Bureau of Land Management, State Highway Commission co-operating; statewide; began January 1953, indefinite; \$35,250; D. L. Eastman and Clifton Lemons, Leaders; reports available.

Address inquiries to: A. V. Meyers, as in No. 1 above.

U. S. Fish and Wildlife Service, Branch of Game-fish and Hatcheries

1. Technical Assistance in Fish Cultural Activities

The objective is to establish and revise fish production programs at Federal hatcheries in cooperation with State fishery agencies, in order to best serve the changing needs of the fish distribution areas.

Assistance also is given to fish cultural personnel toward the solution of biological problems of hatchery management, such as disease control, water quality, weed control, fish hauling, and in the introduction of new or improved techniques.

Headquarters - Portland, field work in the several states comprising U. S. Fish and Wildlife Service Region 1; continuing; Zell Parkhurst and W. M. Morton, Leaders.

Address inquiries to: Regional Director, U. S. Fish and Wildlife Service, 1001 N. E. Lloyd Boulevard, Portland 8, Oregon.

2. Fishery Management Surveys

The objective is to establish fishery management programs, based on surveys, primarily for waters on Federally controlled areas, such as Service wildlife refuges, Indian reservations, military installations, and Veterans Administration facilities.

Headquarters - Portland, field work in the several states comprising U. S. Fish and Wildlife Service Region 1; continuing; Zell Parkhurst and W. M. Morton, Leaders.

Address inquiries to: As in No. 1 above.

U. S. Fish and Wildlife Service, River Basin Studies

1. Washoe Project

A creel census and economic survey on the Truckee River in California and Nevada to determine the angling effort, catch, and expenditures in the river areas which will be affected by the authorized Washoe Project.

U. S. Bureau of Reclamation, California Fish and Game Commission and the Nevada Fish and Game Commission cooperating; headquarters - Portland; began 1955, indefinite; \$15,000; Warren Nord, Leader.

Address inquiries to: As in No. 1 above.

2. Upper Snake River Investigations

One of the purposes of this project is to obtain life history data of the native trout stocks that are affected by the constructed Palisades Dam, and which will be affected by the proposed Burns Creek Dam. Another objective is to develop means of keeping trout stocks in the area at a high level of abundance. The project will develop similar information on other water development projects in the area as they are proposed.

U. S. Bureau of Reclamation and Idaho Department of Fish and Game cooperating; headquarters - Portland; began October 1956, indefinite; \$28,000; Arthur S. Hale, Leader.

Address inquiries to: As in No. 1 above.

3. John Day - McNary - Ice Harbor Investigations

A creel census has been started to determine the number of anglers and their success in the areas which are affected or which will be affected by the three projects. McNary Dam is constructed, Ice Harbor Dam is under construction, and John Day Dam is in the planning stage.

U. S. Corps of Engineers cooperating; Columbia and Snake Rivers; began July 1956, indefinite; \$12,000; Robert L. Hacker, Leader.

Address inquiries to: As in No. 1 above.

4. Willamette Basin Flood Control Projects

Creel census data are being obtained from the Cougar, Green Peter, and Hills Creek project areas. These Corps of Engineers' projects are located on the South Fork McKenzie, Middle Santiam, and Middle Fork Willamette Rivers, respectively. The Cougar project is under construction. The others are still in the planning stage.

U. S. Corps of Engineers cooperating; headquarters - Portland; began April 1956, indefinite; \$21,700; Robert L. Hacker, Leader.

Address inquiries to: As in No. 1 above.

5. Clark Fork Basin Survey

This project was initiated to make a basin wide survey of fishery resources. To date a creel census has been made of both the summer trout fishery and the

OREGON (Cont. )

winter whitefish fishery on Ninemile Prairie Project.

U. S. Bureau of Reclamation cooperating; headquarters - Portland; began September 1955, indefinite; \$21,000; Robert L. Hacker, Leader.

Address inquiries to: As in No. 1 above.

PENNSYLVANIA

Fish Commission

1. Determination of Relative Disease Resistance in Several Strains of Trout and Trout Hybrids

Various trout strains and crosses are exposed to infection with furunculosis and ulcer disease. The number of survivors in each group are compared with those obtained using resistant and highly susceptible lots.

Benner Spring Research Station; begins March 1957, to close May 1958; \$150; Arthur D. Bradford, Leader.

Address inquiries to: Arthur D. Bradford, Benner Spring Research Station, Pennsylvania Fish Commission, Bellefonte, Pennsylvania.

2. Study of the Relationship Between Trout Hybrids and Parental Strains Using Serological Methods

Antiserum is produced in rabbits against serum proteins of each of the hybrid trout crosses and parental strains developed through the breeding program at the Benner Spring Research Station. Studies are made of serological cross-reactions that may occur between such strains and crosses.

Benner Spring Research Station; began October 1956, to close September 1958; \$250; Arthur D. Bradford, Leader.

Address inquiries to: Arthur D. Bradford, as in No. 1 above.

3. Investigations of Gizzard Shad Mortality in Pennsylvania Waters of Lake Erie

The primary purpose of the study is to determine the causal factors responsible for the heavy kill of gizzard shad occurring during the early spring months in the Erie (Pennsylvania) harbor region.

Erie; began 1953, indefinite; \$200; Alfred Larsen, Leader; reports available.

Address inquiries to: Alfred Larsen, State Fish Hatchery, Erie, Pennsylvania.

4. Tagging Program, Lake Erie

Commercial and hook-and-line fish species are tagged to determine migratory habits.

Lake Erie; began August 1953, continuing; \$1,000; Alfred Larsen, Leader; reports available.

Address inquiries to: Alfred Larsen, as in No. 3 above.

5. Reclamation of Upper Woods Pond

This is a study to determine the result of planting trout in lakes limnologically suited to the species but containing established warm water fish populations. Intensive creel census has been conducted over the last three years and will be continued after total reclamation and restocking with rainbow trout fry and fingerlings.

Wayne County; began September 1956, to close December 1959; \$3,000; Jack G. Miller, Leader; reports available.

Address inquiries to: Gordon L. Trembley, Benner Spring Research Station, Pennsylvania Fish Commission, Bellefonte, Pennsylvania.

PENNSYLVANIA (Cont.)

6. Sea Lamprey Investigations

Investigations are underway to determine the extent of sea lamprey activity in the Pennsylvania waters of Lake Erie. Studies include incidence of scarring and stream surveys during lamprey spawning period.

Began 1952, continuing; \$400; Alfred Larsen, Leader; reports available.

Address inquiries to: Alfred Larsen, as in No. 3 above.

7. Trout Population and Harvest Study

Trout stocked in seven streams statewide were differentially marked as to time of planting. A creel census was conducted on these streams throughout the season. Post season shocking was conducted to determine the number of fish of each planting which remained in the stream. Data were also obtained on unmarked fish and natural reproduction.

Southwestern Pennsylvania; began March 1956, closed November 1956; \$1,000; Jack G. Miller, Leader.

Address inquiries to: Gordon L. Trembley, as in No. 5 above.

8. A Check List and General Distribution of Macroinvertebrates, Especially Insects in Pennsylvania

A compilation of already existing data and collections, both personal and those at Colleges and Universities in Pennsylvania.

Pennsylvania; began June 1956, indefinite; \$200; Daniel G. Reinhold, Leader.

Address inquiries to: Daniel G. Reinhold, 644 West Main Street, Lock Haven, Pennsylvania.

9. Lake Rehabilitation

This project aims to improve both trout and warm water fisheries in lakes through a program of accelerated chemical reclamation. Complete and partial eradications are being attempted in conjunction with draining where possible. Complete eradication and the construction of fish barriers are considered mandatory for the management of trout in lakes. Rotenone is used to depress competition prior to corrective restocking and introductions of predatory game fish species.

Pennsylvania Department of Forests and Waters cooperating; statewide; began October 1954, continuing; \$5,000; DeWayne E. Campbell, Jack G. Miller, Daniel Reinhold, Richard Reppert, Roger Reed, Robert Bielo, and J. Curtis Simes, Leaders.

Address inquiries to: Gordon L. Trembley, as in No. 5 above.

10. Effects of Natural Occurring Acidity Upon Stocked Trout

This project is a study of the problems involved in trout plantings in waters affected by natural occurring acidity. The experiment was conducted in a stream where natural acidity exists in graduated degrees. During 1955 and 1956 fingerling and adult rainbow, brook and brown trout, reared in a limestone hatchery, were tested.

Plans are to test (1) trout reared under soft water conditions (2) several strains of brook trout and (3) progeny of two brook trout which survived the test period.

Centre County; began 1955, to close 1958; \$400; Jack M. Reddecliff, Leader.

Address inquiries to: Gordon L. Trembley, as in No. 5 above.

11. Experimental Fish Management

This project undertakes to test some of the more promising management recommendations for combatting the unbalanced fish populations which underlie poor fishing. Being tested are experimental introductions of predatory species

such as muskellunge walleyes and bass into new waters; water level control where possible on a fall and spring basis; and possible experimental regulations providing stringent size restrictions on predatory game species.

Department of Forest and Waters cooperating; statewide; began May 1953, continuing; \$8,000; Gordon L. Trembley, Leader.

Address inquiries to: Albert S. Hazzard, Pennsylvania Fish Commission, Harrisburg, Pennsylvania.

12. Studies on Establishing Rainbow Trout Runs

The project aims to determine whether a significant run of rainbow trout into tributaries of Lake Erie can be established through plantings of fingerlings. Runs of sexually mature rainbows into several tributaries of Lake Erie occur each spring. A test stream and several tributaries have been stocked with marked rainbow fingerlings every fall beginning in 1952. Netting operations are carried on in the experimental stream each spring to record the number of individuals returning to spawn.

Pennsylvania tributaries of Lake Erie; began August 1952, to close 1961; \$750; Alfred Larsen, Leader; reports available.

Address inquiries to: Gordon L. Trembley, as in No. 5 above.

13. General Stream Survey

This project is an investigation of streams for inventory of chemical, physical, and biological factors relating to fish management. Specific consideration involved in this investigation include determination of basic fertility, rate of flow, gradient, temperatures, cover, shelter, pool-riffle ratio, fish population, pollution degree, and evaluation of watershed management.

Statewide; began 1950, continuing; \$40,000; Robert Bielo, Daniel Reinhold, Richard Reppert, Roger Reed, and Curtis Simes, Leaders; reports available.

Address inquiries to: Gordon L. Trembley, as in No. 5 above.

14. General Lake Survey

This project diagnoses factors limiting production and harvest of lake fishes using common field and laboratory techniques. It includes the use of echo sounding gear and self-contained underwater breathing apparatus. Methods of obtaining estimates of fish populations are studied and a search is under way for more efficient fish collection gear.

Statewide; began June 1949, continuing; \$15,000; DeWayne E. Campbell, Leader; reports available.

Address inquiries to: Gordon L. Trembley, as in No. 5 above.

15. Water Inventory

This project consists of a general biological survey of all of the water areas within the boundaries of the Allegheny National Forest. Plans for coordinating the fish management of these waters, among the cooperating agencies, are being prepared.

U. S. Fish and Wildlife Service and U. S. Forest Service cooperating; Northwestern Pennsylvania; began 1955, closed 1956; \$750; James Otis, Leader.

Address inquiries to: Joseph Bocardy, c/o U. S. Forest Service, Post Office Building, Warren, Pennsylvania.

16. Evaluation of New Trout Diets

New diets and dietary supplements are tested for growth, economy, and other factors. Experiments with fish food pellets have been set up at several fish cultural stations with the objective of converting entirely to this type of food if results are satisfactory. Diets are tested that may be of value for

commercial, private, or sportsmen's club fish cultural activities.

Benner Spring Research Station and major state fish cultural stations; began 1955, continuing; \$3,000; Arthur D. Bradford, Leader.

Address inquiries to: Arthur D. Bradford, as in No. 1 above.

17. Culture of Muskellunge, Northern Pike, and Walleyes in Tanks

Because past fish cultural work with these species in ponds resulted in uncertain fish crops, experiments were designed to use steel tanks (22" x 22" x 10') for this purpose.

Fry of all three species were fed daphnia. Fingerling muskellunge and northern pike received live fish of suitable size as food and fingerling walleyes were fed ground marine fish until planted in the fall. The fish were carefully graded as to sizes.

Fish cultural stations; began March 1955, continuing; Dewey Sorenson, Leader.

Address inquiries to: Dewey Sorenson, Pennsylvania Fish Commission, R. F. D. #3, Bellefonte, Pennsylvania.

18. Selective Breeding Program for Trout and Refinements of Hatchery Techniques

This project involves the application of genetic principles in improving trout strains and developing new ones. Hatchery techniques related to spawning, incubation of eggs, rearing and transportation of trout are investigated.

Benner Spring Research Station; began October 1952, continuing; Keen Buss, Leader; reports available.

Address inquiries to: Gordon L. Trembley, as in No. 5 above.

19. Study of Water Conservation in Pennsylvania as Affected by Current Practices of Various Agencies

This project has as a major aim the accomplishment of uniformity in purpose of various practices influencing stream flow in Pennsylvania. It entails critical analysis of stream clearance projects and channel changes in current efforts to minimize flood damage and attempts to compromise methods to minimize damage to fish habitat.

Department of Forests and Waters, Department of Highways and Water and Power Resources Board cooperating; statewide; began 1956, continuing; \$5,000; Robert Bielo, Daniel Reinhold, Roger Reed, Curtis Simes and Richard Reppert, Leaders.

Address inquiries to: William J. Voigt, Jr., Pennsylvania Fish Commission, Harrisburg, Pennsylvania.

20. The Acquisition and Development of Fishing Lakes and the Acquisition of Access Areas on Public Fishing Waters

Objectives are to provide more lakes for public fishing and to insure ingress and egress to important fishing waters of the State.

Statewide; began 1952, continuing; T. F. O'Hara and Cyril G. Regan, Leaders; reports available.

Address inquiries to: (Acquisition) Cyril G. Regan, Division of Land and Water Acquisition, Pennsylvania Fish Commission, Bellefonte, Pennsylvania, and (Development) Thomas F. O'Hara, Chief Engineer, Pennsylvania Fish Commission, Bellefonte, Pennsylvania.

U. S. Forest Service, Northeastern Forest Experiment Station

1. Water Quality Relations

The objective is to determine the effect of forest management, changes in

vegetation, logging and other access roads, and skid roads upon quality of water. Water quality measurements before treatment of small forested watersheds are compared with quality measured after treatment.

Pennsylvania Department of Forests and Waters and U. S. Geological Survey; headquarters - Upper Darby; began 1951; Kenneth G. Reinhart, Irvin C. Reigner, and Victor S. Jensen, Leaders; reports available.

Address inquiries to: Kenneth G. Reinhart, Mountain State Research Center, Elkins, West Virginia (Allegheny Mts.), Irvin C. Reigner, Kingston Research Center, Kingston, Pennsylvania (Pocono Plateau), and Victor S. Jensen, White Pine-hardwood Research Center, Laconia, New Hampshire (White Mountains).

2. Streamflow Relations

The objective is to determine the influence of forest management practices and changes in vegetation upon streamflow. Research is conducted on small, forested watersheds on which continuous streamflow records taken during a pre-treatment period are compared with records taken after treatment on records from a control watershed. Effects of treatment on water yield, peak flows, and low flows are determined.

Pennsylvania Department of Forests and Waters and U. S. Geological Survey cooperating; headquarters - Upper Darby; began 1951; Kenneth G. Reinhart, Irvin C. Reigner, and Victor S. Jensen, Leaders; reports available.

Address inquiries to: As in No. 1 above.

Lehigh University

1. Study of Effects of Thermal Pollution on Delaware River Fish

Approximately 120,000 g. p. m. of river water is taken from the river to be used as cooling water in a steam electric plant. The water temperature is raised about 26° F. by passage through the plant and then returned to the river. The study being made includes the effects of heated water on river fishes, plankton, aquatic insect populations, and aquatic plants. Chemical and temperature studies are also conducted.

Pennsylvania Power and Light Company cooperating; Martins Creek, Pennsylvania and portion of Delaware River; began December 1955, to close December 1957; F. J. Trembley, Leader.

Address inquiries to: F. J. Trembley, Department of Biology, Lehigh University, Bethlehem, Pennsylvania.

Pennsylvania State University

1. The Effect of Differential Feeding Experiences Upon Survival of Trout in Artificial and Natural Environments

The objective is to test the hypothesis that the food type (natural food versus ground liver) first experienced by trout will be related to their rate of survival under natural and artificial conditions. Four groups of 312 brown trout were fed daphnia, liver, or sequential combinations of these for seven months before release into a natural stream controlled by weirs and traps. A survival count will be made in late November 1956, and again in March 1957, to check winter survival. A controlled fishing test of catchability will be made in April 1957, to determine effects of early feeding experience upon ease of catchability.

Pennsylvania Fish Commission cooperating; Benner Spring Research Station and nearby stream; began January 1956, indefinite; \$2,000; R. E. Stover and J. H. Grosslite, Leaders; reports available.

## PENNSYLVANIA (Cont.)

Address inquiries to: R. E. Stover or J. H. Grosslite, Department of Psychology, The Pennsylvania State University, University Park, Pennsylvania.

### 2. Studies of Diseases of Game and Pan Fish Having a Possible Viral Etiology, Using Cell Cultures in vitro Originating from Normal Fish Tissues

The objectives are: (1) To develop techniques for the production of cell cultures in vitro originating from normal fish tissues; (2) to attempt to isolate and study agents from diseased fish showing lesions of probable viral etiology; and (3) to make epizootiological studies of diseased fish populations for the purpose of eventual disease control.

Pennsylvania Fish Commission cooperating; Pennsylvania State University; began September 1956, to close August 1959; \$4,250; A. D. Bradford and E. H. Ludwig, Leaders.

Address inquiries to: Arthur D. Bradford, Benner Spring Research Station, Pennsylvania Fish Commission, Bellefonte, Pennsylvania.

## RHODE ISLAND

### Division of Fish and Game

#### 1. Pond and Lake Survey

This project is a survey of representative standing inland waters to evaluate them for management needs.

Statewide; began May 1952, to close May 1957; \$10,000; Saul B. Saila, Leader; reports available.

Address inquiries to: Saul B. Saila, Department of Zoology, University of Rhode Island, Kingston, Rhode Island.

#### 2. Striped Bass Physiological Investigations

The objectives are to establish a local race of striped bass in Rhode Island's coastal waters and attempt to establish striped bass in fresh and brackish water ponds. Studies include: (1) The effects of fish pituitary injections on sexual development, (2) the effects of certain synthetic hormones on salt retention and the ability to survive transfers from a more to a less concentrated medium, (3) effects on movements of migrant fish held beyond the normal migration period, (4) effects of thyroid inhibitor on migration and movement, and (5) a study of maximum temperature tolerance in the striped bass.

Headquarters - University of Rhode Island; began March 1956, to close February 1959; \$10,000; Saul B. Saila, Leader.

Address inquiries to: Donald B. Horton, Division of Fish and Game, 83 Park Street, Providence, Rhode Island.

#### 3. Construction and Improvement of Fishing Areas on State-Owned Lands

The objective is to improve sport fishery facilities on state-owned or controlled lands by construction of ponds, stream improvement structures, parking lots, stream-side paths, and other facilities.

Statewide; began December 1953, indefinite; \$23,500; Chester Whaley, Leader; reports available.

Address inquiries to: John M. Cronan, Division of Fish and Game, 83 Park Street, Providence, Rhode Island.

University of Rhode Island

1. Winter Flounder Population Study

By tag and recapture methods this project determines the breeding population in a defined area, the contribution at breeding area to the local fishery, and mortality components.

U. S. Fish and Wildlife Service and the Rhode Island Division of Fish and Game, cooperating; statewide; began September 1956, to close September 1958; \$6,000; Saul B. Sails, Leader.

Address inquiries to: Narragansett Marine Laboratory, Kingston, Rhode Island.

SOUTH CAROLINA

Wildlife Resources Department

1. Lake Greenwood and Lake Murray Fisheries Investigations

The project is concerned with studies to determine the condition of the fisheries and methods by which they may be improved. Presently in operation are population studies using rotenone, population studies using nets, creel census, and age-growth studies.

Began July 1956, to close June 1957; \$8,221; Otho May, Leader.

Address inquiries to: Jefferson C. Fuller, South Carolina Wildlife Resources Department, Box 360, Columbia, South Carolina.

2. Bennettsville Public Fishing Lake and Wildlife Refuge

Three hundred acres of water will be impounded. It will be stocked with bluegill and largemouth bass and will be fertilized.

Near Bennettsville; began August 1955, to close June 1957; \$54,935; Jefferson C. Fuller, Jr., Leader.

Address inquiries to: Jefferson C. Fuller, as in No. 1 above.

3. Camp Croft Public Fishing Area

The purpose of the project is maintenance of the area and management of the 40-acre lake in such a manner as to produce sport fishing.

Spartanburg; began July 1956, to close June 1957; \$3,313; Howard Vise, Leader.

Address inquiries to: Jefferson C. Fuller, as in No. 1 above.

4. Chester County Public Fishing Area

The objective is to construct a 40-acre public fishing lake. This lake will be fertilized and stocked with bluegill and largemouth bass.

Began May 1955, to close June 1957; \$27,436; Jefferson C. Fuller, Jr., Leader.

Address inquiries to: Jefferson C. Fuller, as in No. 1 above.

5. Investigation of Fish Populations in Reservoirs

The general objectives are to obtain more complete data concerning the fisheries of these reservoirs with the view of formulating sound management plans. Studies in operation include: Population studies using rotenone, gill nets and small mesh seines; marking and recovery of striped bass; creel censusing; age and growth; and food habits of the striped bass.

Lake Moultrie and Lake Marion; began July 1956, to close June 1957; \$14,264; R. E. Stevens, Leader; reports available.

Address inquiries to: Jefferson C. Fuller, as in No. 1 above.

## SOUTH CAROLINA (Cont.)

### U. S. Fish and Wildlife Service, Branch of Game-fish and Hatcheries

#### 1. Fisheries Survey of Sumter National Forest Water

Fish population and stream studies are being conducted in order to prepare a stocking program based on established fishery management practices.

Wildlife Resources Department and U. S. Forest Service cooperating; Sumter National Forest; began August 1956, continuing; Marvin A. Smith and Braden Pillow, Leaders.

Address inquiries to: Regional Director, U. S. Fish and Wildlife Service, Peachtree-7th Building, Atlanta 23, Georgia.

## SOUTH DAKOTA

### Department of Game, Fish and Parks

#### 1. Fisheries Investigations of Mainstem, Missouri River Reservoirs

This project aims to provide a basic understanding of fish populations in Fort Randall (70,000 acres) and Gavins Point (30,000 acres) Reservoirs. The project includes: (1) Test netting, seining and poisoning permanently established sampling stations on each reservoir and its tailwaters; (2) sauger tagging in the tailwaters of each reservoir; (3) creel census of Fort Randall Reservoir and tailwaters; and (4) special studies such as the effect of draw-downs to expose carp eggs and qualitative food studies of important fish species.

U. S. Fish and Wildlife Service and U. S. Corps of Engineers cooperating; Missouri River; began June 1954, indefinite; \$15,000; James T. Shields, Leader; reports available.

Address inquiries to: William D. Clothier, Woonsocket, South Dakota.

#### 2. Construction of Public Fishing Lakes

This is a continuing program of new lake construction for recreational purposes.

Statewide; began about 1930, indefinite; \$53,715; Edmund S. Jacobsen, Leader.

Address inquiries to: Edmund S. Jacobsen, Department of Game, Fish and Parks, Pierre, South Dakota.

#### 3. Incidence and Distribution of Fish Parasites

This study represents one segment of a long-range plan to assimilate basic knowledge on the ecology and distribution of fishes within South Dakota. Samples of fish are collected throughout the State by the Game, Fish and Parks Department and submitted to the College for analysis under a cooperative agreement.

South Dakota State College cooperating; statewide; began June 1955, to close July 1957; \$2,000; Ernest J. Huggins, Leader; reports available.

Address inquiries to: William D. Clothier, as in No. 1 above.

#### 4. Statewide Lake Survey

This project is designed to provide quantitative figures on fish population dynamics, habitat potentials and management needs of artificial and natural lakes. Present emphasis is placed on one lake in each major region of the State, representing either a bass-bluegill, walleye-northern pike or trout type. Each type is viewed, primarily, from the standpoint of physical characteristics, water chemistry, fish species composition, age and rate of growth, natural

## SOUTH DAKOTA (Cont.)

reproduction and mortality, angler harvest, and where applicable, return of planted fish. Supplementary information is being collected on up to about six additional lakes in each area.

South Dakota State College cooperating; statewide; began July 1956, to close July 1957; \$37,000; Marvin F. Boussu, Joseph W. Kathrein, and John J. Gaffney, Leaders; reports available.

Address inquiries to: William D. Clothier, as in No. 1 above.

### 5. Chemical Rehabilitation of Lakes

This is a standard continuing program of total fish removal by chemical means from lakes harboring an undesirable game or rough fish population.

Statewide; began August 1953, indefinite; \$3,600; Marvin F. Boussu and Joseph W. Kathrein, Leaders; reports available.

Address inquiries to: William D. Clothier, as in No. 1 above.

## TENNESSEE

### Game and Fish Commission

#### 1. Sauger and Catfish Tagging

The objective is to learn the migration of sauger and catfish from Kentucky Lake. These species have been tagged each winter at Pickwick Dam for the past three years. Tags used are plastic with nylon spinning line.

Tennessee Valley Authority cooperating; Kentucky Lake; began January 1953, continuing; Eugene Cobb, Leader.

Address inquiries to: Eugene Cobb, State Game and Fish Commission, 928 Campbell Street, Jackson, Tennessee.

#### 2. Stream Fertilization Investigation

Considerable progress has been made in recent years in the fertilization of ponds. This project is one attempt to apply the same principles to the inorganic fertilization of warm water streams. Cumberland Plateau streams contain very soft water and due to low water flow from the lack of a ground water supply, become a series of nearly static pools during the summer. Fertilizer was applied to these pools. The value of the practice is being evaluated by the effect on the fish population, growth rates and bottom food production.

Cumberland Plateau; began June 1954, to close January 1957; \$7,000; N. G. Benson, Leader.

Address inquiries to: N. G. Benson, State Game and Fish Commission, 210 Cordell Hull Building, Nashville, Tennessee.

#### 3. Evaluation of Brush Shelters

Studies are being conducted on brush shelters in five coves on Fort Loudon Reservoir. The importance of depth, spacing, size, and construction of brush shelters on fish and fishing will be evaluated. Gill nets and creel census are being used to evaluate the effect of these variables.

Fort Loudon Reservoir; began July 1955, to close June 1958; \$2,000; Billy Carroll, Leader; reports available.

Address inquiries to: Billy Carroll, State Game and Fish Commission, Room 1-G, State Office Building, Knoxville, Tennessee.

#### 4. Lake and Access Area Development

The objectives of this project are to provide access to present fishing

waters and to create new waters in areas where fishing opportunities are limited. About 20 access areas are being developed each year on reservoirs by building roads, boat launching ramps and parking areas. New fishing lake sites are being evaluated as to engineering feasibility and fishermen needs.

Statewide; continuing; \$200,000; Norman G. Benson, Leader; reports available.

Address inquiries to: N. G. Benson, as in No. 2 above.

5. Reelfoot Lake Investigation

Intensive sport and commercial census data are being collected. Growth studies are being made to determine age classes which contribute to both commercial and sport fishing. Data were collected for two years while white crappie were harvested commercially. Commercial exploitation of crappie was stopped, and the study presently is determining the resulting effect on the sport fishing. Other studies include measurement of siltation, influence of fish reproduction, and limnology.

Tiptonville; began August 1953, to close June 1958; \$15,000; Hudson Nichols, Leader; reports available.

Address inquiries to: Hudson Nichols, State Game and Fish Commission, Box 564, Tiptonville, Tennessee.

6. Trout Management

The objectives are to evaluate (1) the influence of diet and condition in the hatchery on the survival rate of stocked trout, (2) the effect of stream improvement structure on stream capacity, (3) the influence of "fly fishing only" and "large minnow size limit" on stream reared trout, and (4) the benefit of stocking Southern Appalachian brook trout. The objectives are being evaluated by creel census and by population studies with cresol.

Eastern Tennessee; began January 1954, continuing; \$4,000; Price Wilkins, Leader; reports available.

Address inquiries to: Price Wilkins, State Game and Fish Commission, Room 1-G State Office Building, Knoxville, Tennessee.

7. Large Impoundment Creel Census and Population Studies

The objective of this study is to establish an estimate of the fish populations and harvest in large impoundments. The relationship of harvest to population is also a phase of this study. Estimates will be made on the total yield of fish to sport fishermen on three impoundments. Fishermen counts have been made by plane to arrive at an estimate of the total harvest. Previous data gathered on total yield are being evaluated to devise some permanent method of establishing harvest trends on lakes. Annual population studies are conducted with rotenone. New techniques are being tested for determining trends in reservoir populations.

Statewide; began July 1955, to close 1960; \$30,000; N. G. Benson, Leader; reports available.

Address inquiries to: Norman G. Benson, as in No. 2 above.

8. Farm Pond Management and Investigation

District Biologists check population balance in ponds at request of pond owners. Weed control recommendations are made if necessary. Continuous research is conducted at State hatcheries and on other ponds on the influence of new herbicides on fish and their value in controlling weeds. Twenty-seven ponds at the Tennessee Agricultural Experiment Station are being used for experimental stocking and fertilization studies. Yellow bass, brown bullheads and longnose gar are being tested in ponds. Work is also conducted on controlling

overpopulation of bluegills by using wire traps and large seines.

Statewide; continuing; \$15,000; Eugene S. Cobb, Leader.

Address inquiries to: Eugene S. Cobb, State Game and Fish Commission, 928 Campbell Street, Jackson, Tennessee.

9. Warm Water Stream Management

A survey of the warm water streams in Tennessee has been completed. Studies on the management of certain warm water streams are being undertaken on the value of stocking, degree of seasonal migrations of fish from reservoirs, and control of non-stream species. Population estimates are made on all streams prior to instituting new forms of management. The value and influence of old mill dams and other obstructions on certain streams is being evaluated. Species of fish that are being stocked experimentally are smallmouth bass, bluegills and largemouth bass. Creel census, population studies, and growth studies are being used to evaluate the effect of the experimental management practices.

Middle and East Tennessee; began July 1955, to close June 1958; \$8,000; C. E. Ruhr, Leader; reports available.

Address inquiries to: C. E. Ruhr, State Game and Fish Commission, 210 Cordell Hull Building, Nashville, Tennessee.

10. Steam Plant Investigations

Water from this steam plant is about 10° F. above regular lake temperatures during the winter months. Fish concentrate in the discharge harbor below the plant at certain periods in mid-winter. The objectives of this study are to determine (1) seasonal fish concentrations, (2) seasonal plankton production and (3) influence of warm water on other sections of the reservoir. Netting and plankton work have been conducted in addition to creel census.

Johnsonville Stream Plant; began July 1955, to close June 1957; \$1,000; Norman G. Benson, Leader; Reports available.

Address inquiries to: Norman G. Benson, as in No. 2 above.

11. Fish Population and Movement of Fish in Kentucky Lake

The purpose of the project is to determine movements of fish relative to season, depth, and habitat. Gear used include gill nets, hoop nets, and wire baskets. They have been fished through one year under four different ecological conditions. These include areas defined by (1) restriction of lake to old river channel, (2) slight emergence from original channel, (3) confluence in lake of several large tributary rivers, and (4) broad expanses of relatively shallow water. Catches are evaluated according to species, habitat, and depth. All game fish are tagged. Several new tags have been tested. Growth studies are included.

T. V. A. cooperating; Kentucky Lake; began August 1955, to close June 1957; \$5,000; William Dryer, Leader; reports available.

Address inquiries to: William Dryer, State Game and Fish Commission, box 337, Waverly, Tennessee.

Reelfoot Lake Biological Station

1. Age and Rate of Growth of Fish in Reelfoot Lake

The objective is to determine the age and rate of growth of fish in Reelfoot Lake.

Tennessee Academy of Science cooperating; Reelfoot Lake, Tennessee; began June 1937, indefinite; C. L. Baker, Leader; reports available.

Address inquiries to: C. L. Baker, Southwestern College, Memphis 12, Tennessee.

Tennessee Valley Authority

1. Annual Fall Fish Population Inventory of T. V. A. Reservoirs

Information is collected on the success of reproduction and survival of the young, growth and size distribution of different species, available food for game fish, trends in relative abundance of species, the presence or absence of certain species, need for commercial fishing on T. V. A. mainstream reservoirs, and need for introduction of new species. Small areas, 1 to 5 acres, are treated with rotenone in cove and deep water areas, all fish are removed, separated to species, counted, weighed and measured, and scale samples taken.

Conservation Departments of Tennessee Valley States cooperating; headquarters - Decatur, Alabama, and Norris, Tennessee; began 1945, continuing; Ben D. Jaco and C. J. Chance, Leaders.

Address inquiries to: A. H. Wiebe, Chief, Fish and Game Branch, Norris, Tennessee.

2. Spring Creel Census on T. V. A. Reservoirs and Tailwaters

The census is designed to determine qualitative and quantitative trends in the catch, residence of fishermen, fishing methods, hours fished, catch per hour by number and weight, and type of license during a limited season of April, May, and June on certain reservoirs and tailwaters. A census is taken daily at selected stations but no attempt is made to census entire reservoir.

Alabama Department of Conservation and Mississippi Game and Fish Commission cooperating; Wheeler and Pickwick Reservoirs; began 1945, continuing; \$1,000; Ben D. Jaco, Leader.

Address inquiries to: A. H. Wiebe, as in No. 1 above.

3. Fish Harvesting on T. V. A. Reservoirs

Fish are netted, caught by hook and line or removed from sinkholes and tagged with Monel metal jaw tags. These studies are made to determine the extent to which the available crop is harvested, the migration of fishes-- especially upstream movement of some species at spawning time, the periodical concentration in the tailwaters, movement between reservoirs, especially mainstreams, and to gain an idea of changes in populations. Investigations are carried out on both storage and mainstream reservoirs, but not on all reservoirs simultaneously.

Tennessee Game and Fish Commission cooperating; ten reservoirs; began 1945, continuing; C. J. Chance and Ben D. Jaco, Leaders; reports available.

Address inquiries to: A. H. Wiebe, as in No. 1 above.

4. Environmental Studies

These studies are designed to determine the fitness of the environment for the existence and perpetuation of a given species of fish. They include studies on water level fluctuations, determination of spawning temperatures, thermal and oxygen stratification, discharges of deoxygenated water through turbines into tailwater concentrations of fish, discharge of toxic materials into impoundments, and evaluation of the effect upon the fishery of mosquito larvicides.

Reservoirs in Tennessee Valley; began 1937-1938, continuing; C. J. Chance and Ben D. Jaco, Leaders; reports available.

Address inquiries to: A. H. Wiebe, as in No. 1 above.

## TEXAS

### Game and Fish Commission

#### 1. Fisheries Investigations and Surveys

Basic surveys to obtain physical, chemical, and biological data, fish populations characteristics, and pollution sources are conducted throughout the State. Experimental control of rough fish and aquatic weeds is also carried on.

Statewide; began February 1956, indefinite; \$28,681; Kenneth Jurgens, Leo D. Lewis, E. W. Bonn, Lawrence Campbell, Leonard Lamb; Charles Gray, Elgin M. C. Dietz, Alvin Flury, and Billy D. Cooper, Leaders; reports available.

Address inquiries to: Kenneth Jurgens, Game and Fish Commission, Walton State Building, Austin, Texas.

#### 2. Caddo Lake Water Hyacinth Control Project

A development job carried out during the fiscal year was the Caddo Lake water hyacinth control project. Water hyacinths have covered from 1,500 to 2,000 acres of Caddo Lake in the past four or five years causing much of the lake to be impassable to boats. These plants were sprayed with 40 percent Amine 2,4-D and emulsifiable oil. Spraying is being continued at the present time.

Marion and Harrison Counties; began April 1956, closed November 1956; \$20,219; Charles E. Gray, Leader; reports available.

Address inquiries to: Charles E. Gray, Box 8, Marshall, Texas.

#### 3. Statewide Rough Fish Control

Lake Inks, a lake of approximately 850 acres, was treated with Pro-Noxfish in an attempt to improve fishing by reducing gizzard shad. The lake was treated at the rate of 0.12 p.p.m. Pro-Noxfish in shallow water and at 0.13 p.p.m. in water over 10 feet in depth. In the deeper water, only the upper 10 feet of the lake was treated.

Statewide; began November 1956, to close October 1957; \$7,475; Regional Biologists, Leaders; reports available.

Address inquiries to: Marion Toole, Game and Fish Commission, Walton State Building, Austin, Texas.

### U. S. Fish and Wildlife Service, Branch of Game-fish and Hatcheries

#### 1. Modified Production System - Warm Water Species

Artificial feeding in lieu of fertilization, grading, and other production methods are being applied to largemouth bass, redear, and channel catfish in ponds and raceways.

San Marcos; began July 1956, continuing; \$3,000; Fred Richan, Leader.

Address inquiries to: Regional Director, U. S. Fish and Wildlife Service, P. O. Box 1306, Albuquerque, New Mexico.

### U. S. Fish and Wildlife Service, Office of River Basin Studies

#### 1. Silt Problem in Sabine Lake

The purpose of this investigation is to determine the benefits to the fish resources of the Sabine Lake area if silt dredged from the Sabine-Neches and Port Arthur Waterways is kept from entering Sabine Lake. Field work consists of determining man-day use made of the lake and harvest. Data are gathered on the sources and types of pollution, chemical, and biological analysis of the lake's water, and physical description of the project area.

## TEXAS (Cont.)

Texas Game and Fish Commission, cooperating; southeastern Texas; began August 1956, closed November 1956; John G. Degani, Leader; reports available. Address inquiries to: John G. Degani, 300 W. Vickery Boulevard, Room 2187, Fort Worth 4, Texas.

## UTAH

### Fish and Game Department

#### 1. An Inventory Survey of Utah's Fishing Waters

An inventory survey for the purposes of collecting and analyzing physical, chemical, and biological data to provide a basis for management and stocking recommendations and to recognize existing problems that require future study.

Statewide; began March 1953, to close 1959; \$35,000; Donald C. Hales, Leader; reports available.

Address inquiries to: J. Perry Egan, Director, Utah State Department of Fish and Game, 1596 West North Temple, Salt Lake City, Utah.

#### 2. Provo River, Fish Lake, and Strawberry, Scofield and Deer Creek Reservoirs

A fisherman count and interview program on each fishery designed to yield estimates of harvest of all game fish, including fin-clipped rainbow trout, fishing pressure, success per unit effort, length frequencies, and license fees contributed by fishermen who fished these waters.

Wasatch, Utah, Sevier, and Carbon Counties; began December 1953, to close December 1957; \$19,000; Hal W. Peterson, Leader.

Address inquiries to: J. Perry Egan, as in No. 1 above.

#### 3. Investigations of Brine Shrimp

The objectives are: (1) To learn methods of harvesting adult brine shrimp from Great Salt Lake and determine the best storage methods; (2) to determine the economics, quantities necessary, methods and merits of a feeding program involving brine shrimp; (3) to develop methods of harvesting brine shrimp eggs along the shores of Great Salt Lake and to develop methods of hatching.

Great Salt Lake and Scott Avenue Hatchery, Salt Lake City; began May 1955, closed September 1956; \$11,500; John Neuhold, Leader; reports available.

Address inquiries to: J. Perry Egan, as in No. 1 above.

#### 4. Statewide Rough Fish Eradication Project

The objective is to eradicate populations of rough fish in lakes and reservoirs that can be reclaimed for game fish.

Statewide; began August 1953, continuing; Donald C. Hales, Leader.

Address inquiries to: J. Perry Egan, as in No. 1 above.

### Utah State Agricultural College

#### 1. The Toxicity of Fluorides to Fresh Water Fish

Lethal and chronic levels of fluoride concentrations for fresh water fish and fish eggs through the medium of water; changes in the chemistry of the water medium during the course of the experiment; levels of concentration and distribution of fluorine in fish and fish eggs which have been subjected to known concentrations of fluorides; concentrations of fluorides in various natural waters inhabited by fish; levels of concentration and distribution of fluorine in fish from various natural waters are determined. The effect of

## UTAH (Cont.)

known concentrations of fluorides on the growth rate of the common goldfish over a specific period of time and the specific action of fluorides on the organ systems of goldfish are also investigated.

U. S. Public Health Service cooperating; Logan; began September 1956, to close August 1958; \$16,000; William F. Sigler, Leader; reports available.

Address inquiries to: Department of Wildlife Management, School of Forestry, Logan, Utah.

### 2. The Life History and Economic Status of the Carp in Utah

This project involves study of reproduction, annual and standing crop in small ponds or impoundments, and methods of harvesting carp, other than with electric shocking machines. Observations on general ecology and food and feeding habits are also made.

Headquarters - Logan; began 1952, to close 1958; \$1,000; William F. Sigler, Leader; reports available.

Address inquiries to: As in No. 1 above.

### 3. Some Aspects of the Limnology of the Logan River, Utah, with Special Reference to the Drift Algae and Periphyton

The objectives are: (1) To determine what species of algae are free floating in the river, (2) to determine the origin of the cells, (3) to determine the abundance of the various species and how the abundance changes along the river and during the year, and (4) to determine how changes in temperature, turbidity, velocity, and volume of flow affect species composition and abundance of plankton.

The principle object of the periphyton study is the evaluation of environmental factors influencing the distribution, quality and abundance of periphyton in Logan River and how they relate to sampling methods. The factors to be considered are: velocity and acceleration of water currents, insulation, water temperature, water chemistry, substrate roughness and composition, water depth, and turbidity.

U. S. Public Health Service cooperating; headquarters - Logan; began September 1955, to close August 1957; \$8,000; William F. Sigler, Leader; reports available.

Address inquiries to: As in No. 1 above.

## VERMONT

### Fish and Game Service

#### 1. Fishing Investigation and Experimental Population Control of Some Vermont Lakes

Objectives of the project are to devise and evaluate methods of controlling warm water fish populations without complete poisoning.

Statewide; began January 1954; \$7,600; James D. Stewart, Leader; reports available.

Address inquiries to: James D. Stewart, R. F. D., Milton, Vermont.

#### 2. Fishing Access Acquisition

The objective is to purchase in the name of the State of Vermont a small tract of land on each lake and pond over 20 acres in surface area, suitable for boat launching and vehicle parking.

Statewide; began October 1953, continuing; \$7,373; Roger A. Seamans, Leader.

Address inquiries to: Roger A. Seamans, Vermont Fish and Game Service, Montpelier, Vermont.

## VIRGINIA

### Commission of Game and Inland Fisheries

#### 1. Fisheries Management Investigations of Impoundments

The objectives of this project are to evaluate the application of various management techniques and regulations changes. Under this segment of the project five activities are being investigated: (1) The effects of drainage and subsequent population manipulation on growth and population composition of selected ponds. In most instances, the ponds are completely drained and all fish weighed according to specified size groups. Only those size groups and species thought desirable are returned. (2) The effects of year-round bass fishing on the creel and influence upon growth rates and population composition. (3) An evaluation of the effectiveness of threadfin shad in increasing populations of predator fishes such as largemouth bass in situations where no other plankton feeding forage species is present. (4) An evaluation of chain pickerel introductions in reducing the numbers and thus increasing the growth rates of panfishes. (5) An evaluation of the effectiveness of brush shelters in attracting panfishes.

Statewide; began July 1954, to close June 1957; \$33,000; Robert G. Martin, Leader; reports available.

Address inquiries to: Robert G. Martin, Fish Division, Commission of Game and Inland Fisheries, Seven North Second Street, Richmond 13, Virginia.

#### 2. Survey of Trout and Smallmouth Bass Streams

The ultimate objective of this project is to collect sufficient biological, chemical, and physical data from trout and smallmouth bass streams to enable the formulation of general management recommendations. Likewise, short term investigations of specific problems are to be undertaken as the need arises.

The survey is to proceed systematically, treating each watershed as a single unit. It is expected that three years will be required to complete the survey. The bulk of the survey activities will be concentrated during the summer months with seasonal labor. Present short term investigations include: (1) an evaluation of post-season trout populations in selected streams, (2) an evaluation of winter carry-over in selected streams, (3) studies to determine the relationship between time of pre-season stocking and recovery of stocked trout, and (4) studies to determine the effects of in-season stocking carried out on an isolated closed-pool plan.

Statewide; began July 1955, June 1958; \$29,700; Jack M. Hoffman, Leader; reports available.

Address inquiries to: Robert G. Martin, as in No. 1 above.

#### 3. Scott County Pond Construction

This project is one segment of a statewide program designed to provide additional public fishing waters in areas devoid of adequate facilities.

Scott County; began September 1956, to close January 1957; \$53,980; G. W. Buller, Leader; reports available.

Address inquiries to: G. W. Buller, Commission of Game and Inland Fisheries, Seven North Second Street, Richmond, Virginia.

### Virginia Fisheries Laboratory

#### 1. Inventory of Saltwater Sport Fisheries

The project is concerned with the sport fisheries of the tidal waters of Chesapeake Bay and its tributaries in Virginia. The species composition of the catch and the total annual catch of each species are determined. Data on length, weight, and age are collected also. Information is gathered by

## VIRGINIA (Cont.)

interviews, log books, post-cards, and boat counts by bridge tenders and from the air.

Began April 1955, continuing; \$65,000; C. E. Richards, Leader.

Address inquiries to: J. L. McHugh, Director, Virginia Fisheries Laboratory, Gloucester Point, Virginia.

### U. S. Fish and Wildlife Service, Branch of Game-fish and Hatcheries

#### 1. Fisheries Survey of George Washington National Forest Water

Fish population and stream studies are being conducted in order to revise and improve the existing stocking program.

Commission of Game and Inland Fisheries and U. S. Forest Service cooperating; George Washington National Forest; began August 1956, continuing; Marvin A. Smith and Braden Pillow, Leaders.

Address inquiries to: Regional Director, Fish and Wildlife Service, Peachtree - 7th Building, Atlanta, Georgia.

## WASHINGTON

### Department of Fisheries

#### 1. Nutritional Investigation

The objectives are to investigate: (1) all nutritional disorders occurring in salmon hatcheries and prescribe corrections, (2) various possible diet components for worth in improving current production diet, (3) various commercial fish foods for possible application to salmon feeds, and (4) other biological problems related to salmon hatcheries.

Statewide; began June 1953, continuing; J. A. Coates, Leader; reports available.

Address inquiries to: State of Washington, Department of Fisheries, 4015 - 20th Avenue West, Seattle 99, Washington.

#### 2. Salmon Migration Studies

This project involves tagging and finmarking of silver, pink, and chinook salmon to determine migration routes, individual stocks, and catch within the sport and commercial fisheries. Emphasis is placed on establishing migration trends within the Puget Sound waters. Recoveries of tagged fish are obtained mainly from the sport fishery.

Puget Sound; began 1949, indefinite; \$15,000; Hans M. Jensen, Leader; reports available.

Address inquiries to: Hans M. Jensen, Washington State Department of Fisheries, 4015 - 20th Avenue West, Seattle 99, Washington.

#### 3. Baker Lake Spawning Studies

This project involves construction of artificial spawning grounds for salmon to replace areas that will be inundated from dam construction. A complete system of man-made spawning grounds with all physical properties of the area is controlled by mechanical means.

Fish will be held for maturing and then introduced on the spawning area. Various environmental conditions will be changed to determine optimum conditions for spawning and incubation of the eggs.

Puget Sound Power and Light Company cooperating; Baker Lake; began 1954, to close 1958; \$77,000; Elmer Quistorff, Leader; reports available.

## WASHINGTON (Cont.)

Address inquiries to: Elmer Quistorff, Washington State Department of Fisheries, Fisheries Center, University of Washington, Seattle 5, Washington.

### 4. Salmon Sport Fishery Investigation

A continuous 12-month creel census of the salt water salmon sport fishery to determine the magnitude of the catch of the four species of salmon landed. Emphasis is also directed to obtain age and size composition of the catch in relation to season, area, and type of lure used. The catch is also sampled for recovery of fin-marked fish to evaluate success of various hatchery plants.

Puget Sound and Columbia River; began 1949, continuing; \$12,000; Albert Lasater, Leader; reports available.

Address inquiries to: Albert Lasater, Washington State Department of Fisheries, 4015 - 20th Avenue West, Seattle 99, Washington.

### 5. Disease Investigation

The objectives are to investigate all diseases of salmon occurring in State hatcheries to determine the causative agent or agents, and to devise methods and treatments for the control of such diseases.

University of Washington cooperating; University of Washington and salmon hatcheries; began 1951, continuing; Brian J. Earp, Leader; reports available.

Address inquiries to: Brian J. Earp, 230 Fisheries Center, University of Washington, Seattle 5, Washington.

### 6. Capitol Lake Ecology Study

An investigation of a newly created lake measuring productivity for rearing young salmon prior to migration to salt water. This program includes the study of rates of growth, timing of plankton blooms with reference to planting of hatchery fry and the resulting utilization of available food.

Capitol Lake Washington; began 1954, indefinite; \$8,000; James Fitzgerald, Leader; reports available.

Address inquiries to: James Fitzgerald, Washington Department of Fisheries, 417 G. General Administration Building, Olympia, Washington.

## Game Department

### 1. Purchase and Development of Public Fishing Areas

Thirty public fishing areas have been developed, and 25 new ones acquired. Development includes providing adequate parking space and such grading and filling as necessary in order to launch boats. The boundaries are fenced to prevent intrusion on neighboring property. Sanitary facilities including toilets and garbage pits are provided.

Statewide; began 1954-55, indefinite; \$200,000; Oliver Edwards and James Lyons, Leaders.

Address inquiries to: Clarence F. Pautzke, Chief, Fishery Management Division, Department of Game, 509 Fairview Avenue North, Seattle 9, Washington.

### 2. Study of American Merganser Predation on Pure Trout Lakes

Stomach samples were taken from 15 mergansers which were collected from lakes containing pure trout populations.

King and Snohomish Counties; began November 1953, indefinite; \$300; Harry Senn, Leader.

Address inquiries to: Clarence F. Pautzke, as in No. 1 above.

3. Fishway and Holding Pond for Steelhead

The objective is to design a fishway which would induce steelhead to return to the holding pond without being handled. The mature run of steelhead has used the ladder in preference to ascending the main stream channel. The use of natural rock formations and controlled water flows were essential features in making the fishway functional.

Washougal; began June 1956; \$50,000; Marvin Hull, Leader.

Address inquiries to: Clarence F. Pautzke, as in No. 1 above.

4. Determining the Survival, in Vertical Free Fall, of Salmonoid Fishes

The experiment was designed to determine the survival of salmonoid fishes in vertical free falls. A helicopter was used to drop fish into a holding pond at the State Game Department's Puyallup Hatchery. The size of fish and the height of drop varied in this experiment.

Puyallup; began 1956, closed 1956; \$500; Robert J. Rennie, Leader.

Address inquiries to: Clarence F. Pautzke, as in No. 1 above.

5. Summer Run Steelhead Investigations

The objectives are to investigate the possibility of holding adult summer run steelhead for spawn taking and to determine the success of rearing and releasing the resultant fingerlings. This work was conducted with adult steelhead trapped from the Columbia River at Bonneville Dam in July. These fish were held at the Goldendale Hatchery and spawned the following spring. Migrant size fingerlings resulting from this spawn taking were marked and released into the Klockitat River, a tributary of the Columbia River.

Began 1951, closed 1956; \$1,000; Robert J. Rennie, Leader.

Address inquiries to: Clarence F. Pautzke, as in No. 1 above.

6. Collecting and Tabulating Catch Record Information

The project consists of two parts: (1) The catch of steelhead during the winter season (December through April) is calculated by the use of a punch card which is returned by the fishermen. At the present time about 90,000 steelhead punch cards are issued during the winter season. (2) Data of catches during the summer season are collected from catch record cards sent in by resort owners on many of our lakes. Also, the spot checks, which are made on lakes and streams by game protectors, are tabulated.

Seattle; continuing; \$4,000; Atley O. Nelson, Leader; reports available.

Address inquiries to: Clarence F. Pautzke, as in No. 1 above.

7. Acquisition of Streambank Access

This project involves acquisition and development of streambank property. Statewide; began 1953, indefinite; \$6,000; Carroll A. Rieck, Leader.

Address inquiries to: Clarence F. Pautzke, as in No. 1 above.

University of Washington

1. Effects of Electricity on Salmon

The objectives are to determine the possibility of using electricity to guide young downstream-migrant salmon and steelhead trout, at dams and other water usage projects, into areas of safe passage and to determine whether the use of electricity in guiding will be injurious to the fish.

U. S. Army Corps of Engineers cooperating; began July 1953, to close July 1957; \$53,000; Leon A. Verhoeven, Leader.

Address inquiries to: School of Fisheries, University of Washington, Seattle 5, Washington.

2. Fish Guiding

The objective is to determine non-electrical means of guiding young downstream, migrant salmon and steelhead trout, at dams and other water usage projects, into areas of safe passage. The present studies have been concerned primarily with the use of light to divert salmonoids into desired areas.

U. S. Army Corps of Engineers cooperating; began July 1953, to close July 1957; \$38,000; Paul E. Fields, Leader.

Address inquiries to: As in No. 1 above.

3. Water Quality Studies

The objectives are to collect, analyze, and document information concerning past and existing water qualities of sections of the Columbia River system near sites of proposed dams. The data will be evaluated to ascertain the changes in water quality which are taking place now and the changes which may take place as the result of the proposed dams.

U. S. Fish and Wildlife Service cooperating; began May 1954, to close June 1957; \$9,800; Robert O. Sylvester, Leader.

Address inquiries to: Robert O. Sylvester, Civil Engineering Department, University of Washington, Seattle 5, Washington.

4. North Pacific Salmon Studies

Development of serological and other methods for the identification of specific strains of the bacterium Chondrococcus columnaris from salmon and determination of the geographical distribution and relationship of the strains to host fishes. The initial phase of the study has dealt primarily with fishes from the Columbia River. The ultimate objective is the determination of the feasibility of using microorganisms to identify races of salmon. Information regarding the consequence of the organisms as a cause of mortalities in salmon is also being sought.

Marine Vibrios, metacercariae of the fluke (Trogloitrema salmincola) and the etiological agents of kidney disease and tuberculosis are some of the organisms singled out for specific study.

U. S. Fish and Wildlife Service cooperating; began July 1955, to close June 1957; \$6,800; Erling J. Ordal, Leader.

Address inquiries to: As in No. 1 above.

5. Salmon Fatigue Studies

The objective is to study the swimming abilities of adult upstream migrant salmon and steelhead to learn the capacities of these fish to perform physically. Specific study is being made of: (1) the length of time various swimming speeds can be maintained; (2) the maximum swimming speed which can be attained; (3) the effects of fatigue induced by prolonged swimming activity on time required for recovery after complete exhaustion and life span; and (4) the effects of environmental conditions on swimming performances.

U. S. Army Corps of Engineers cooperating; began June 1954, to close 1957; \$40,000; Allan C. DeLacy, Leader.

Address inquiries to: As in No. 1 above.

Washington State College

1. The Relation of Preference of Pacific Salmon to Experimentally Induced Physiological Reactions

The objective of this project is to determine the relationship of endocrine activity to reactions of salmon fingerlings to temperature, salinity, carbon-dioxide tension, and water flow.

U. S. Fish and Wildlife Service cooperating; Washington State College; began June 1954, to close May 1957; \$8,752; F. D. Klopfer, Leader.

Address inquiries to: F. D. Klopfer, Department of Psychology, State College of Washington, Pullman, Washington.

U. S. Fish and Wildlife Service, Branch of Fishery Biology

1. Temperature Regimen of the Columbia River System

The original objective was to obtain records of water temperatures of Columbia River and its tributaries prior to construction of the dams. With many more reservoirs being created, the resulting temperature changes and their effect upon migrating fish are being studied.

Columbia River; began 1945, continuing; \$3,630; K. G. Weber, Leader.

Address inquiries to: Clinton E. Atkinson, Chief, Pacific Salmon Investigations, 2725 Montlake Boulevard, Seattle 2, Washington.

2. Season and Biology of Fingerling Salmon Migration at Bonneville Dam

This project was initiated to: (1) determine the species, origin (hatchery or natural propagation), size, age, and the time of seaward migration of salmon and steelhead fingerlings, and (2) to estimate the percentage migration of salmon and steelhead fingerlings through spillway and power house channels.

Bonneville Dam; began 1946, continuing; \$10,370; K. G. Weber, Leader.

Address inquiries to: Clinton E. Atkinson, as in No. 1 above.

3. Electrical Guiding of Fishes

The general objective is to develop a safe practical method of guiding fish with electricity, with particular reference to directing the movements of salmon fingerlings on their downstream migration. Controlled laboratory experiments will determine: (1) the electrical characteristics most effective in controlling fish movements, (2) the electrical properties injurious to fish, (3) the most desirable electrical field patterns, and (4) the most desirable types of electrodes, electrode spacing, and switching sequences.

Seattle; began 1951, to close 1961; \$37,312; G. B. Collins and H. W. Newman, Leaders; reports available.

Address inquiries to: Clinton E. Atkinson, as in No. 1 above.

4. Squawfish (Ptychocheilus) Predation Control by Electricity

The areas of the Columbia River where hatchery salmon are released have been observed to concentrate numbers of squawfish, which are detrimental to the salmon released. This project was initiated to develop the most effective electrical means of controlling, deflecting, or separating squawfish of several sizes from seaward migrant salmon fingerlings and trout. The data to be collected will be: (1) the most effective electrical fields in blocking the movements of adult squawfish, by controlled laboratory experiments, (2) electrical conditions lethal to adult and fingerling squawfish, and (3) the most effective electrical conditions in concentrating adult and fingerling squawfish into small areas for capture or lethal shocking.

Seattle; began 1955, to close 1958; \$23,689; G. H. Maxfield, Leader.

Address inquiries to: Clinton E. Atkinson, as in No. 1 above.

5. Experimental Electrical Guiding of Fish in the Field

This project was developed to find a practical means of guiding fish with electricity on a field scale, and to: (1) extend experimental procedures beyond the physical and electrical capabilities of the laboratory; (2) repeat and confirm experimental laboratory tests.

Columbia River; began 1954, to close 1957; \$61,200; J. E. Mason, Leader.  
Address inquiries to: Clinton E. Atkinson, as in No. 1 above.

6. Sonic Fish Tracking

This project is developing and using echo sounding equipment to track the movements and obtain detailed information on the behavior patterns of up-stream migrant adult salmon under natural conditions in relation to dams in the northwest. A sonic fish tag is attached to an adult salmon and its movements are tracked with calibrated sonic receiving equipment which automatically "homes" on the signal transmitted by the tag and pinpoints the position of the fish. Resulting information will aid in the design and location of fish passage facilities at new dams.

Seattle; began 1954, continuing; R26,508; Parker S. Trefethen, Leader; reports available.

Address inquiries to: Clinton E. Atkinson, as in No. 1 above.

7. Fresh Water Survival of Bluback Salmon (O. nerka) on the Okanogan River

This project was initiated to conserve the Okanogan River blueback salmon run during and following construction of flood control projects. The following are the general objectives: (1) check incubating eggs in gravel for mortalities, (2) determine time fry emerge from the gravel and migrate to the lake so that flood control construction work can proceed, (3) make observations of spawning, and (4) study productivity following completion of flood control project.

Washington State Department of Fisheries and Canadian Department of Fisheries cooperating; Okanogan River; began 1951, to close 1963; \$16,531; K. G. Weber, Leader.

Address inquiries to: Clinton E. Atkinson, as in No. 1 above.

8. Electronic Fish Counting

The major objective is to develop automatic systems to count anadromous fish by species and telemeter counts to a central station. Instruments have been developed to count salmon and modifications are rapidly being developed. Also important is developing the art of using the systems in typical installations. There are plans to modify the consecutive-type counter to battery power, and for use in a portable unit. A photographic unit is being studied and planned for improved counting. There is continued development of passage tunnels to meet requirements of specific field-test sites.

Seattle; began May 1954, continuing; \$22,000; Julius Rockwell, Jr., Leader; reports available.

Address inquiries to: Clinton E. Atkinson, as in No. 1 above.

9. North Pacific Salmon Research Investigations

The basic objective of this investigation is to distinguish the races of Pacific salmon of the United States, Canada, and Alaska from the Asiatic stocks of salmon. The studies making up the investigation are: salmon serology, age (scale) analysis, meristic studies (morphology and morphometrics), parasitology, oceanographic studies, tagging on high seas, ocean distribution studies, and osteological studies. Collections of salmon are made on the high seas and in the coastal areas of the United States, Canada, and Alaska. During the summer of 1955, 8,500 salmon were collected, 5,500 of which were used for meristic studies. The past summer, 24,000 salmon were collected to be used as follows: 19,000 for meristic studies, 3,000 for parasitology, 1,000 for osteological studies, and 1,000 were sent to Japan. The osteological studies are being carried out by Canada.

University of Washington cooperating; headquarters - Seattle; began 1955, continuing; \$700,000; Clinton E. Atkinson, Leader; reports available.

Address inquiries to: As in No. 1 above.

10. Research of Fishway Problems

The Bonneville Research Facility was constructed to acquire information that will make possible the design of more efficient and more economical fish passage facilities for both upstream and downstream migrant salmon. Full scale fishway situations are created under controlled laboratory conditions and the reactions of migratory fish are measured as the fish actually migrate through them. The project also seeks systematically the principles of fish orientation that are basic to the design of adequate fish passage facilities.

Corps of Engineers cooperating; Bonneville Dam; began 1955, to close 1960; \$63,059; G. B. Collins, C. H. Elling and H. L. Raymond, Leader.

Address inquiries to: Clinton E. Atkinson, as in No. 1 above.

11. Predator and Competitor Studies of Resident Fishes

This project aims to measure the impact of predatory and competitive fishes upon resident and migratory game and commercial fishes of the Columbia River. The important phases of the study will be the distribution and abundance of scrapfish populations, particularly in relation to salmon spawning and nursery areas; scrapfish predation on young salmon; food competition between scrapfishes and young salmon; space competition; and the effects of scrapfish as vectors of diseases affecting salmonoids.

Columbia River; began July 1956, continuing; \$16,326; R. B. Thompson, Leader.

Address inquiries to: Clinton E. Atkinson, as in No. 1 above.

12. Development of Hatchery Equipment and Techniques

All phases of hatchery procedure are explored for the purpose of improving equipment and techniques.

Salmon-cultural Laboratory, Entiat; began 1948, continuing; \$10,000; Roger E. Burrows, Leader; reports available.

Address inquiries to: Roger E. Burrows, Salmon-Cultural Laboratory, Entiat, Washington.

13. Development of Better Practical Diets

A survey by means of feeding trials to explore growth potential and nutritional adequacy of potential fish food products and to develop practical diets for salmon.

Salmon-cultural Laboratory, Entiat; began 1948, continuing; \$3,000; Roger E. Burrows, Leader; reports available.

Address inquiries to: Roger E. Burrows, as in No. 12 above.

14. Disease Research

Studies indicate that parasites, bacteria, and virus-like agents are major causes of serious losses among fish populations. This investigation studies the etiologic agents, their effects on fish, methods of transmission, sources, identification, and determines methods for control.

University of Washington; began September 1952, continuing; \$32,500; Robert R. Rucker, Leader; reports available.

Address inquiries to: Western Fish Disease Laboratory, Fisheries Center, University of Washington, Seattle 5, Washington.

15. Comparative Histology of Salmonids

The objectives are to determine the normal histology of the organs and tissues of salmonids and to define the change brought about under particular nutritional deficiencies and other pathological conditions.

Willard; began August 1953, continuing; John E. Halver, Leader.

Address inquiries to: John E. Halver, Chief, Salmon Nutrition Laboratory, Cook, Washington.

16. The Nutritional Requirements of Chinook Salmon

A study to determine the quantitative nutritional requirements of chinook salmon in terms of the basic nutrients and to define the metabolic role of each nutrient.

Willard; began September 1951, continuing; John E. Halver, Leader.

Address inquiries to: John E. Halver, as in No. 15 above.

17. Study of Influencing Factors on King Salmon Egg to Fry Survival in Mill Creek, California

The general objectives of egg to fry survival studies in this project are to determine: (1) the survival rate of spawn and factors influencing mortality under simulated natural conditions, (2) an optimum spawning population in relation to a given number of square yards of spawning gravel, (3) the survival rates of spawn under hatchery methods when compared to simulated natural conditions, (4) if there are advantages in the "Vibert" hatching boxes over natural hatching or hatchery methods, (5) the difference, if any, in the survival rate of spawn from early, peak, or late run adults, (6) the effect of various sex ratios on production of young salmon, and (7) the calculated fresh water mortality in the stream based on upstream counts of several years' runs and samples of downstream migrating fry.

Headquarters- Seattle; Los Molinas; began 1952, to close 1962; \$21,804;

H. A. Gangmark, Leader; reports available.

Address inquiries to: Clinton E. Atkinson, as in No. 1 above.

WEST VIRGINIA

Conservation Commission

1. Population Manipulation Studies on West Virginia Smallmouth Bass Streams

Primary project objective was to evaluate population manipulation in streams as a tool of fish management. Different segments of the fish population were removed from three experimental streams with the effect of such removal on remaining fish being studied.

Other objectives were improvement of electrical fishing gear, creel census, studies, study of natural population fluctuations, and population studies in streams of West Virginia's eastern panhandle.

Petersburg; began May 1952, closed July 1956; \$20,000; Carl Sullivan, Leader; reports available.

Address inquiries to: Carl Sullivan, Division of Fish Management, Charleston, West Virginia.

2. Lake Construction and Development Program

This project consists of construction of public fishing lakes.

Began January 1949, indefinite; \$65,000; Harry Van Meter, Leader.

Address inquiries to: Harry Van Meter, Chief, Division of Fish Management, Charleston, West Virginia.

3. Small Impoundments Investigation and Research

This project was initiated to determine the best fish management techniques for farm ponds and small impoundments in West Virginia. In accordance with this aim; the introduction of new sunfish species is being studied, pond weed and algae control methods are being evaluated, burrowing crayfish control measures tried, and various harvesting technique including trapping studied. Most experiments are being conducted in experimental ponds located at the Palestine State Fish Hatchery.

Elizabeth; began May 1953, to close June 1959; \$9,000; Harvey Beall, Leader; reports available.

Address inquiries to: Carl Sullivan, as in No. 1 above.

4. Investigation of Coal Pollution in Streams

The objects of the project are: to determine the location and source of pollution, to record the biological changes as pollution abatement progresses and determine the measures necessary to restore desired fishing conditions.

Madison; began April 1956, to close April 1959; \$18,000; Robert Davison, Leader; reports available.

Address inquiries to: Carl Sullivan, as in No. 1 above.

5. Fisheries Investigations of Selected Tributaries of the Upper Ohio

This investigational project is aimed at providing basic information relative to the fishery in the Ohio River tributary streams of northern West Virginia. Chief objectives are to obtain a clear picture of the fish population in study streams, to obtain information concerning the possible extensive migrations of fish either within tributary streams or between tributaries and the Ohio River, and to provide data necessary to more intelligently approach the management goal of maximum utilization and sustained fish harvest.

Middlebourne; began July 1956, to close July 1959; \$20,000; Peter Zurbuch, Leader; reports available.

Address inquiries to: Carl Sullivan, as in No. 1 above.

6. National Forest Fish Management Program

Stream surveys, stream improvement, location of lake sites, and experimental trout studies are all part of the activities which are supervised by a fishery biologist located in the national forest area. One of the primary objectives is to improve the trout distribution methods and techniques for assuring the optimum returns in angler success.

U. S. Forest Service cooperating; Monongahela and George Washington National Forests; began January 1952, indefinite; \$12,000; reports available.

Address inquiries to: Harry Van Meter, as in No. 2 above.

7. Cataloging of Streams

The objective was to catalogue all streams large enough to sustain a fish population. Each stream was assigned an identification (code) number made up of a combination of letters and numbers. With the aid of a legend any stream can be located from its code number.

Statewide; began July 1955, closed July 1956; \$1,000; Robert Davison, Leader.

Address inquiries to: Harry Van Meter, as in No. 2 above.

8. Introduction of Other Game Fish Species

Various game fish species have been stocked in an effort to establish or re-establish these species in particular areas of the State. Kokanee salmon were introduced in several impounded waters with hope of providing an

WEST VIRGINIA (Cont.)

additional game fish for the angler's creel. The walleye, yellowbelly sunfish, and white bass were experimentally stocked in other impoundments and stream systems in which they were not present.

Statewide; began March 1952, indefinite; \$2,000; Harry Van Meter, Leader; reports available.

Address inquiries to: Harry Van Meter, as in No. 2 above.

9. Distribution of West Virginia Fishes

Collections of fishes were continued on all major streams and tributaries in order to acquire knowledge of the different species present, their range of distribution and abundance. Formerly handled through Cornell University, the identification and mapping is now being done through West Virginia University. In conjunction with this work, scale samples and measurements of numerous game fish species are being recorded for determining the general growth rate patterns in various waters of the State.

West Virginia University and Cornell University cooperating; statewide; began January 1951, indefinite; \$1,000; Harry Van Meter, Leader; reports available.

Address inquiries to: Harry Van Meter, as in No. 2 above.

10. Management of Public Fishing Areas

Impoundments in state parks and forests and other state-owned areas undergo a periodic check to determine if, and what, measures are needed to bring about an improvement in fishing conditions. This includes both warm water and trout lakes.

Statewide; began June 1949, indefinite; \$6,000; Harry Van Meter, Leader; reports available.

Address inquiries to: Harry Van Meter, as in No. 2 above.

West Virginia University

1. Investigation of the Cheat River Watershed

This project consists of a physical, chemical, and biological survey of the Cheat River and tributaries. It was established in response to a decline in the fish populations throughout the watershed.

Monongahela, Preston, Tucker, Randolph, Pocahontas Counties; September 1955, to close October 1956; \$2,000; Frank J. Schwartz, Leader; reports available.

Address inquiries to: Frank J. Schwartz, Department of Biology, West Virginia University, Morgantown, West Virginia.

2. Studies on the Life Histories of Notropis cerasinus and Notropis ardens from the Roanoke River

This project concerns food studies on both species year round, growth rates, sexual dimorphism, sex ratios, and population densities.

Montgomery County; began April 1955, to close April 1957; Frank J. Schwartz, Leader.

Address inquiries to: Frank J. Schwartz, as in No. 1 above.

U. S. Fish and Wildlife Service, Branch of Fishery Biology

1. Kidney Disease

Studies are in progress on the ways in which this disease spreads in nature and on the selection of the most promising drugs for its cure. Treatment with sulfonamides and antibiotics are being studied.

Kearneysville; began 1953, to close 1957; Ken E. Wolf, Leader; reports available.

Address inquiries to: Microbiological Laboratory, U. S. Fish and Wildlife Service, Kearneysville, West Virginia.

2. Fish Furunculosis

Sulfonamides have been widely used for the treatment of this disease during the past decade. As a result, the sulfa resistant variant of the pathogen has appeared. In order to select the best possible treatment it is necessary to determine rapidly to which drugs the pathogen is most susceptible. A method has been perfected for such a purpose.

Kearneysville; began 1955, closed 1956; S. F. Snieszko, Leader; reports available.

Address inquiries to: S. F. Snieszko, Microbiological Laboratory, U. S. Fish and Wildlife Service, Kearneysville, West Virginia.

3. Disease Resistance in the Eastern Brook Trout

It has been confirmed that there are significant differences in resistance to furunculosis and ulcer disease among strains of brook trout which are maintained at different hatcheries. Such strains were compared under uniform conditions at Leetown to determine variation in resistance to these diseases.

Kearneysville; began 1954, closed 1956; S. F. Snieszko, Leader; reports available.

Address inquiries to: S. F. Snieszko, as in No. 2 above.

4. Blue-sac Disease

This project is concerned primarily with the determination of the causes of this disease.

Kearneysville; began 1955, to close 1957; Ken E. Wolf, Leader; reports available.

Address inquiries to: S. F. Snieszko, as in No. 2 above.

5. Cultivation of Fish Tissues in Test Tubes

Development of tissue culture techniques is under way to aid in the study on the nature of control of infectious diseases.

Kearneysville; began 1955, indefinite; Ken E. Wolf, Leader.

Address inquiries to: S. F. Snieszko, as in No. 2 above.

6. Diagnostic and Consulting Service

Diagnostic and consulting service in the field of fish diseases is carried out primarily for the federal fish hatcheries located east of the Mississippi River. When time and facilities permit this service is extended also to state and private hatcheries. Recently a survey on the distribution of kidney disease in trout hatcheries was carried out in the central and northeastern states.

Kearneysville; continuing; Robert G. Piper, Leader.

Address inquiries to: S. F. Snieszko, as in No. 2 above.

7. Trout Stream Ecology

The objective is to determine the principal factors affecting the production of trout and other fish in streams of the Shenandoah and Great Smoky Mountains National Parks.

Studies on water quality and on periphyton are continuing. Inventories of fish populations are made annually on selected watersheds with electro-fishing

and chemo-fishing equipment. Information is obtained on the abundance of trout and other species per acre of water, on the relationships between trout and rough fish, on the upstream and downstream limits of each species, on size distributions, and on the reproduction, survival, growth and condition of eastern brook trout, rainbow trout, and smallmouth bass.

U. S. National Park Service, Virginia Commission of Game and Inland Fisheries, North Carolina Wildlife Resources Commission, and Tennessee Game and Fish Commission cooperating; Shenandoah National Park in Virginia, Great Smoky Mountains National Park in Tennessee and North Carolina; began October 1952, continuing; \$10,000; Robert E. Lennon, Leader; reports available.

Address inquiries to: Robert E. Lennon, Chief, Eastern Federal Waters Investigations, Leetown (P. O. Kearneysville), West Virginia

8. Creel Census on Streams in Great Smoky Mountains National Park

The objective is to determine the annual harvest of eastern brook trout, rainbow trout, and smallmouth bass from selected streams in the park.

Information is obtained on the quality of fishing, in terms of legal fish caught per hour of angling effort; on the size, condition, and age of the fish; on the return to the creel of marked wild and stocked trout; on the preference of anglers for wild or stocked trout; and on the relationships between the numbers of catchable size fish present to the total numbers harvested. Data are obtained on the numbers of anglers, the intensity of fishing pressure per unit area of water, the distribution of fishing pressures on easily accessible and remote waters, and on the distribution of the catch among out-of-state fishermen.

U. S. National Park Service, cooperating; Great Smoky Mountains National Park in Tennessee and North Carolina; began May 1953, continuing; \$5,000; Phillip S. Parker, Leader; reports available.

Address inquiries to: Robert E. Lennon, as in No. 7 above.

9. The Effects of the "Hazard-plan" of Sport-fishing-only on Trout Streams in Great Smoky Mountains National Park

The objectives in applying the Hazard-plan of sport-fishing-only on two streams were to determine the effects on the rainbow and brook trout populations and the reaction of the angling public to the idea.

Two streams were selected in 1954 for testing the Hazard plan, one on the Tennessee side and the other on the North Carolina side of the park. Fishing has been permitted during the open season with the following restrictions: only artificial lures permitted, and all fish caught must be returned to the stream.

U. S. National Park Service cooperating; Great Smoky Mountains National Park; began May 1954, continuing; \$5,000; Robert E. Lennon, Leader.

Address inquiries to: Robert E. Lennon, as in No. 7 above.

10. Restoration of Native-strain Brook Trout in Great Smoky Mountains National Park

The objective of the project is to determine the feasibility of restoring native-strain brook trout in streams where the exotic rainbow trout have been permitted to usurp brook trout habitats, or where the exotic species have been reduced or destroyed by flood or drought.

The recent availability of Appalachian-strain brook trout from hatcheries has made it possible to experiment with fingerling and legal-size plants in selected streams.

Arrangements have been made to eradicate wild rainbow trout populations

in two streams in 1957 and to restock them with marked fingerlings of the Appalachian strain of brook trout.

U. S. National Park Service, cooperating; Great Smoky Mountains National Park; began June 1954, continuing; \$8,000; Robert E. Lennon, Leader.

Address inquiries to: Robert E. Lennon, as in No. 7 above.

## WISCONSIN

### Conservation Department

#### 1. Life History and Management of Brook Trout in Lawrence Creek

A complete creel census and semi-annual population estimates are being conducted on three miles of trout stream. Different angling regulations are being tested during different seasons to determine optimum regulations for brook trout management. The value of refuge areas and dynamics of an unfished brook trout population are being studied.

Adams and Marquette Counties; began April 1955, indefinite; \$15,000; James T. McFadden, Leader; reports available.

Address inquiries to: James T. McFadden, Lawrence Creek Research Station, Route #2, Westfield, Wisconsin.

#### 2. Rate of Exploitation of Warm Water Fishes in a Small Flowage

The objective is to determine the use by anglers of populations of northern pike, muskellunge, largemouth bass, bluegill, black crappies and other warm water fishes under various angling regulations.

A complete record of fishing statistics is maintained by use of a free permit system of fishing during specified daily hours. Population estimates by mark and recapture methods by trap netting and based on angler caught fish are accomplished for comparison with harvest figures.

The rate of growth of fishes present is determined from data collected at the checking station.

Rusk County; began April 1955, indefinite; \$20,000; Donald K. Dunham, Leader; reports available.

Address inquiries to: Wisconsin Conservation Department, Northwest Area Headquarters, Spooner, Wisconsin.

#### 3. Evaluation of Stocking Fingerling Walleye in Escanaba Lake

The objectives are to determine the survival rate and return to the angler of walleye fingerling stocked in a lake where a walleye population is already present, and their effect on the harvest and the existing population. Marked walleye fingerling were stocked in 1954, and a second stocking is contemplated for 1957. A complete record of the harvest is kept by a compulsory permit system, and all fish taken from the lake are examined by department personnel. Year-round fishing is permitted, without size or bag limit. Annual estimates of the population are made by the marking and recovery method to determine rates of exploitation and mortality.

Vilas County; began May 1953, continuing; \$20,000; Warren Churchill, Leader.

Address inquiries to: Warren Churchill, Wisconsin Conservation Department, Woodruff, Wisconsin.

#### 4. Life History and Management of Muskellunge

The objectives are: (1) To determine behavior of muskellunge under varied feeding, space, light, temperatures and other conditions. (2) To determine

the number, quantity, size and kind of food items that are taken by muskellunge. (3) To determine age, rate of growth, length-weight changes of muskellunge and to correlate with the available food. (4) To determine the physical, chemical and biological conditions that are present in rearing ponds and to determine which of these conditions, if any, are optimum for muskellunge growth. (5) To develop and test methods for marking fish other than the conventional finclip methods. (6) To determine the relative survival of small and large size muskellunge that are stocked in lakes.

Spoooner; began April 1953, indefinite; \$7,000; Leon D. Johnson, Leader; reports available.

Address inquiries to: Fish Management Division, Wisconsin Conservation Department, Spooner, Wisconsin.

5. Evaluation of Watershed Stabilization Practices on Trout Streams

The objectives are to evaluate the degree of improvement or stability resulting from various modifications made within different watersheds and their streams.

The project aims at study of changes in physical and biological conditions, such as water temperatures, total fish populations, fish yield, natural reproduction, fish food, cover, stability of water flow and changes in the degree of siltation.

These studies evaluate conditions for trout in streams before and after stream improvement. Different kinds of trout streams with different improvement problems are selected.

U. S. Soil Conservation Services and U. S. Geological Survey cooperating; statewide; began December 1953, to close December 1961; \$25,000; Oscar M. Brynildson, Leader; reports available.

Address inquiries to: Oscar M. Brynildson, Nevin State Fish Hatchery, Route 3, Madison 5, Wisconsin.

6. Management of Lake Sturgeon

Records of all speared sturgeon are analyzed annually and the age composition of the catch is compared annually to ascertain exploitation. Tagging studies are continuing in an effort to follow the effect migration has on exploitation and management. Studies are being made of the species spawning habits, early life history, size and age of first maturity, and frequency of spawning.

Lake Winnebago and associated lakes and tributaries; began January 1953, to close June 1958; \$12,500; reports available.

Address inquiries to: Thomas L. Wirth, Box 358, Oshkosh, Wisconsin.

7. Experimental Angling With Artificial Flies Only on Peshtigo River

The object of the project is to evaluate public reaction to a 12-inch size limit and flying fishing only regulations on a trout stream, and to determine the composition of the catch and the contribution of stocked fish and fish from a feeder stream.

Marinette County; began April 1956, to close September 1958; \$3,000; John Klingbiel, Leader; reports available.

Address inquiries to: John Klingbiel, Northeast Area, Conservation Department, Woodruff, Wisconsin.

8. Effect of Removal of Fresh Water Drum on Other Game Fishes

Fresh water drum are considered as rough fish and have been removed in limited quantities for over 20 years. The annual removal of this species has been increased 7-fold in recent years in an attempt to severely reduce the

standing population and better lake habitat for more favored game species. It is also hoped that heavy drum production will increase growth and fatness of the now thin and slow growing drum. Presently, monthly drum samples of 400-500 fish are randomly selected for assessing length-weight relationships of the current population throughout the year. Age and rate of growth studies of the drum are conducted annually and detailed catch statistics are maintained to follow trends in game fish and drum populations.

Lake Winnebago; began April 1953, to close June 1958; \$12,500; Thomas L. Wirth, Leader; reports available.

Address inquiries to: Thomas L. Wirth, Wisconsin Conservation Department, Box 358, Oshkosh, Wisconsin.

9. Movements of Whitefish in Western Lake Superior

A total of 1,700 whitefish were tagged in order to study migratory habits, annual growth, and seasonal distribution. One phase of the study is to determine whether or not present legal size regulations are suitable to the fishery. All fish were tagged directly from commercial pound nets at four different locations in the Apostle Island area. Fish ranged in size from 14 to 17 inches. Tags used were an individually numbered streamer type attached posterior to the dorsal fin with No. 49 Nylock thread. It is anticipated that an additional 2,000 whitefish will be tagged during the 1957 season.

Apostle Island area, Lake Superior; began June 1955, to close November 1959; \$850; Russell Daly, Leader; reports available.

Address inquiries to: Russell Daly, State Fish Hatchery, Bayfield, Wisconsin.

10. Studies of the Food Competition Between Carp, Largemouth Bass, and Bluegills

This study is being conducted to determine if carp compete with largemouth bass and bluegills for the available supply of food. Samples of adult and young of the year carp, largemouth bass and bluegills were sampled periodically throughout the summer for stomach analysis.

Warm Water Research Station, Delafield; began April 1, 1956, to close June 1958; \$7,704; Arthur R. Ensing, Leader.

Address inquiries to: Arthur R. Ensing, Warm Water Research Station, Box 396, Delafield, Wisconsin.

11. Management Studies of Carp, Largemouth Bass and Bluegill

The relationship between carp, largemouth bass and bluegills in the lakes of southeastern Wisconsin, is determined by means of studies of growth rates, mortality rates, success of reproduction and the harvest of largemouth bass with liberalized fishing regulations. The work done on this project in 1956 consisted of summarizing the work completed in 1955 and drawing comparisons with the data from 1953.

Browns Lake and the Warm Water Research Station, Delafield; began Spring 1953, to close June 1957; \$8,424; Donald Mraz, Leader; reports available.

Address inquiries to: Donald Mraz, Warm Water Research Station, Box 396, Delafield, Wisconsin.

12. Management Studies of Lake Trout in Big Green Lake

This project was established to determine the reasons for fluctuations in abundance of lake trout as well as the role of stocked fish. Natural reproduction and growth rates are studied. All lake trout stocked since 1953 have been marked.

## WISCONSIN (Cont.)

Green Lake County; began September 1952, to close June 1958; \$1,900; Vernon A. Hacker, Leader.

Address inquiries to: Vernon A. Hacker, Wisconsin Conservation Department, Box 358, Oshkosh, Wisconsin.

### 13. Control of Sea Lamprey Populations in Wisconsin Streams Tributary to Lake Michigan

A cooperative project for the control of sea lamprey.

U. S. Fish and Wildlife Service cooperating; Green Bay and Lake Michigan; began April 1945, indefinite; \$6,000; Lawrence W. Wiegert, Leader; reports available.

Address inquiries to: Lawrence W. Wiegert, Wisconsin Conservation Department, Box 605, Green Bay, Wisconsin.

### 14. Area Watershed Stabilization

This project is basically composed of three activities: (1) Land management on state-owned property. (2) Habitat management on specific and limited areas. (3) Cooperation with other agencies. Demonstration areas are established.

Statewide; began January 1952, continuing; \$181,000; D. John O'Donnell, Leader; reports available.

Address inquiries to: D. John O'Donnell, Wisconsin Conservation Department, Madison, Wisconsin.

## The Institute of Paper Chemistry

### 1. A Study of Habitat Improvement Below Pulp and Paper Mills and Tolerance Limits to Environmental Change

This project determines the effect of mill process improvement on fish and food organisms as well as the tolerance of sensitive species to lowered oxygen concentration.

Appleton; began 1945, continuing; Willis M. Van Horn, Leader; reports available.

Address inquiries to: Willis M. Van Horn, The Institute of Paper Chemistry, Appleton, Wisconsin.

## Sulphite Pulp Manufacturers' Research League

### 1. Cooperative State and Industry Stream Studies

A broad, long-term study concerned with the capacity of streams for self purification and for producing fish food from the wastes of nature and of man. Extensive base data have been secured from intensive studies on Wisconsin rivers and streams during 1955 and 1956. Specific projects, such as evaluation of fish food potentials under properly controlled conditions, are developing from the base studies.

State Board of Health, University of Wisconsin and others cooperating; Fox, Wisconsin, Flambeau, and Oconto Rivers; began April 1955, indefinite; \$25,000; reports available.

Address inquiries to: T. F. Wisniewski, Director, Wisconsin Committee on Water Pollution, State Office Building, Madison, Wisconsin.

Committee on Water Pollution

1. Badfish Creek Investigations

This project was initiated to determine the biological and chemical effects of the proposed diversion of the treated effluent of the Madison Metropolitan District Sewage Treatment Plant into this stream. Weekly chemical analyses and bimonthly plankton determinations are being made, as well as studies on bottom organisms, fish and aquatic plants. Pre-diversion stream conditions are being examined at the present time.

Headquarters - Madison; began April 1956, to close 1960; \$1,500; K. M. Mackenthun, Leader.

Address inquiries to: T. F. Wisniewski, Director; Committee on Water Pollution, State Office Building, Madison 2, Wisconsin.

University of Wisconsin

1. Orientation and Migration of Fishes

The objectives are to determine the sensory mechanisms used by fishes in returning to a territory when displaced and to study the sun-compass abilities of fishes.

Office of Naval Research cooperating; began 1952, to close 1957; \$6,000; Arthur D. Hasler, Leader; reports available.

Address inquiries to: A. D. Hasler, University of Wisconsin, Birge Hall, Madison 6, Wisconsin.

2. Reactions of Fishes to Conventional and Experimental Fishing Gear

The objectives are to study the reactions of fishes to conventional fishing gear and to develop collecting methods for the inland waters of Wisconsin which will be better adapted to take advantage of the fishes behavior.

Conservation Department cooperating; Lake Mendota and other areas; began 1954, to close 1957; \$5,900; Warren J. Wisby and John Miller, Leaders; reports available.

Address inquiries to: A. D. Hasler, as in No. 1 above.

3. Reactions of Fishes to Experimental Electro-fishing Gear

The objectives are to study the reactions of fishes to electro-fishing methods and to design an electrical apparatus which can be used to capture fishes in the inland lakes of Wisconsin.

Conservation Department cooperating; Lake Mendota and other areas; began 1954, to close 1957; \$12,000; Richard L. Pierce and Warren J. Wisby, Leaders.

Address inquiries to: A. D. Hasler, as in No. 1 above.

4. Investigations of the Yellow Bass Fishery of Lake Wingra

The objectives are to study the fish inhabiting the lake, with emphasis on the yellow bass and to learn more about their ecological relationships.

Conservation Department cooperating; Dane County; began 1954, to close 1957; \$4,500; William T. Helm and John C. Neess, Leaders; reports available.

Address inquiries to: A. D. Hasler, as in No. 1 above.

5. The Biology of Trout and Bass in Artificially Alkalized Bog Lakes

The objectives are: (1) To appraise the competition between rainbow trout and bass. (2) To determine stocking rates and carrying capacities of treated bog lakes for trout. (3) To evaluate alkalization of bog lakes. (4) To conduct studies on the problem of winterkill in small lakes.

## WISCONSIN (Cont. )

Conservation Department cooperating; Vilas and Chippewa Counties; began June 1952, indefinite; \$12,000; William R. Schmitz, Arthur D. Hasler, and Raymond Stross, Leaders; reports available.

Address inquiries to: Arthur D. Hasler, as in No. 1 above.

### 6. Introductory Study of the White Bass, Lepibema chrysops (Rafinesque), in Lake Mendota and Associated Waters

The objectives are to continue the study of the life history and ecology of the white bass, with emphasis placed on reproductive characteristics, behavior, and meteorological factors influencing distribution and movement.

Conservation Department cooperating; Dane County; began 1954, to close 1957; \$4,500; A. D. Hasler and Ross M. Horrall, Leaders; reports available.

Address inquiries to: Arthur D. Hasler, as in No. 1 above.

### 7. Distribution of Pelagic Fishes

The objective is to study the distribution and movements of the pelagic fishes in Lake Mendota and Trout Lake.

Conservation Department and Office of Naval Research cooperating; Dane and Vilas Counties; began 1953, to close 1957; \$5,000; Arthur D. Hasler, Warren J. Wisby, and David LaDuke, Leaders; reports available.

Address inquiries to: Arthur D. Hasler, as in No. 1 above.

## WYOMING

### Game and Fish Commission

#### 1. Game and Fish Laboratory Research

This project consists of various activities including a study of fish diseases and other causes of mortality, marking and tagging experiments, pollution studies, diet investigations, and development of an electric bottom fauna separator.

Statewide; began July 1953, continuing; \$31,200; George Post, Leader; reports available.

Address inquiries to: Wyoming Game and Fish Research Laboratory, Chemistry-Zoology Building, University of Wyoming, Laramie, Wyoming.

#### 2. A Study of the Effect of Fertilization on Trout Growth in an Alpine Lake in Wyoming

During the past two summers preliminary studies of the chemical conditions, plankton, bottom fauna production, and the food habits and growth of fish in two adjacent alpine lakes have been conducted. Early in the summer of 1956, inorganic fertilizer was added to one of these lakes while the other was held as a control lake for comparison of over-all production and particularly fish growth between the fertilized and unfertilized lake.

South central Wyoming; began July 1954, to close January 1959; \$1,990; George T. Baxter; Leader; reports available.

Address inquiries to: George T. Baxter, Chemistry-Zoology Building, University of Wyoming, Laramie, Wyoming.

#### 3. Trout Survival Studies

The object of these studies is to determine sizes, species and time of planting which will provide the greatest yield to the creel for various types of waters. Emphasis is placed on two stream studies and one lake study. Marked fish are planted. Evaluation is based on creel census and fish population studies.

University of Wyoming cooperating; Big Laramie River, Middle Fork Powder River, Middle Piney Lake; began January 1952, to close December 1958; Jack J. Kanaly, John W. Mueller, and Fred W. Jackson, Leaders; reports available.

Address inquiries to: Jack J. Kanaly, Wyoming Game and Fish Commission, Cheyenne, Wyoming.

4. North Platte River Reservoirs Study

When the Bureau of Reclamation completes Glendo Dam on the North Platte River the surface area of the nine major impoundments in the State will more than double the combined area of natural lakes and smaller impoundments. This project was inaugurated to study fish management in these waters. The North Platte River Reservoirs are being studied in particular. During the current year, emphasis was placed on an evaluation of stocking procedures, on studying the possibilities of increasing natural spawning, on rough fish control, and on obtaining basic information on the fish population, harvest, and aquatic environment in general.

University of Wyoming cooperating; North Platte River; began June 1954, continuing; \$15,560; Lawrence W. Peterson, Leader; reports available.

Address inquiries to: Lawrence W. Peterson, Wyoming Game and Fish Commission, Cheyenne, Wyoming.

5. Experimental Rough Fish Control

An intensive carp control program consisting of seining and spot poisoning is under way. The objective of the study is to determine the effect on carp and game fish populations and on the aquatic environment in general.

Ocean Lake; began January 1955, to close December 1958; Fred M. Eiserman, Leader; reports available.

Address inquiries to: Fred M. Eiserman, Wyoming Game and Fish Commission, Cheyenne, Wyoming.

6. A Study of Competition Between Brown Trout and Rocky Mountain Whitefish

The objective is to ascertain if some component of the environment or the presence of Rocky Mountain whitefish is the limiting factor on brown trout populations in Tongue River. The available food, water flows, water temperatures and surface acreage of the stream are being studied. Information on populations, food habits, migratory habits, length-weight relationships and age and growth rates has been collected for both species.

Sheridan County; began April 1952, closed December 1956; Charles L. Sowards, Leader; reports available.

Address inquiries to: Charles L. Sowards, Wyoming Game and Fish Commission, Cheyenne, Wyoming.

7. A Study of Factors Affecting Game Fish Production in Sand Creek

Sand Creek, with a standing crop of 250 pounds of trout per acre, is possibly the most productive stream in the State. This project was initiated to determine some of the basic factors influencing the productivity of this stream so comparisons can be made with other waters and any future changes in Sand Creek can be better understood. An intensive study is being made in a 1,600-foot section. This includes preparation of a map showing extent of aquatic vegetation beds and silt deposits; study of age, growth and condition of trout, their spawning areas and food habits; and collection of chemical and temperature data.

Began 1956, to close December 1957; Charles L. Sowards, Leader.

Address inquiries to: Charles L. Sowards, as in No. 6 above.

8. Techniques and Equipment Used in Fisheries Work

The object of the project is to improve methods for gathering and treating data. Phases under study are the use of trawls to collect fish from Wyoming waters and the development of a statewide gill net index to aid in the evaluation of gill netting data. Statistical methods are employed.

University of Wyoming cooperating; statewide; began July 1955, to close December 1957; Fred W. Jackson and Thomas H. Leik, Leaders; reports available.

Address inquiries to: Fred W. Jackson (trawl experiment) or Thomas H. Leik (gill net index), Wyoming Game and Fish Commission, Cheyenne, Wyoming.

10. Studies on Life Histories of Burbot and Cutthroat Trout

Life history studies have been undertaken on burbot and cutthroat trout to gain knowledge needed for the preservation of these species. In each case, particular emphasis is being placed on spawning habits.

Wind River Drainage and Snake River drainage; began January 1955, continuing; Fred M. Eiserman and Delbert H. Rasmussen, Leaders.

Address inquiries to: Fred M. Eiserman or Delbert H. Rasmussen, Wyoming Game and Fish Commission, Cheyenne, Wyoming.

11. Lake, Stream, and Farm Pond Surveys

Surveys of particular importance include initiation of a systematic survey of waters in Snowy Range Division of Medicine Bow National Forest and the Clear Creek Drainage in northern Wyoming.

Statewide; began January 1951, continuing; Fred T. Williams, John W. Mueller, and Charles L. Sowards, Leaders.

Address inquiries to: Fred T. Williams, John W. Mueller or Charoes L. Sowards, Wyoming Game and Fish Commission, Cheyenne, Wyoming.

12. Manipulation of Fish Populations in Streams

The object of this project is to determine when it is practical to reduce or eradicate fish populations in streams to benefit desired species. Fish toxicants, shockers and seines are employed. Evaluation is based on follow-up studies. Seven streams are involved ranging from the North Platte River, one of the largest in Wyoming which was chemically treated to eliminate suckers from 26 miles, to small creeks. Brown trout and mountain whitefish have been experimentally removed in addition to non-game species.

Statewide; began June 1954, continuing; George D. Holton, Leader.

Address inquiries to: Supervisor, Fisheries Field and Research Operations, Wyoming Game and Fish Commission, Cheyenne, Wyoming.

13. Lake and Pond Rehabilitation

As a management procedure, lakes and ponds with off-balance fish populations are chemically treated to eliminate the existing fish and are restocked with desirable species.

Statewide; began July 1950, continuing; George D. Holton, Leader.

Address inquiries to: As in No. 12 above.

14. Statewide Creel Census

The object of this study is to determine the most practical method for Wyoming to use in determining statewide trends in fishing pressure, success and harvest and distribution of fishing pressure. During 1956, fisherman counts on all important waters in southeastern Wyoming were made periodically by air and ground observers. Also, a study was inaugurated to evaluate the possibilities of a mail fishing survey.

WYOMING (Cont. )

University of Wyoming cooperating; statewide; began July 1955, to close December 1958; George D. Holton, Leader.

Address inquiries to: Supervisor, Fisheries Field and Research Operations, Wyoming Game and Fish Commission.

U. S. Fish and Wildlife Service, Branch of Fishery Biology

1. Grebe Lake Studies

The objective is to determine the best management practices for the welfare of grayling in Grebe Lake. The presence of trout, egg-taking, and angling are factors which complicate the problem. Studies have centered around measurements and counts of survival and mortality at all life history stages.

Yellowstone Park; began June 1952, closed September 1956; \$2,000; Oliver B. Cope, Leader.

Address inquiries to: Oliver B. Cope, Forestry Building, Utah State Agricultural College, Logan, Utah.

2. Madison-Firehole-Gibbon Rivers Studies

The objective is to determine the best stocking methods for the Madison, Firehole, and Gibbon Rivers in Yellowstone National Park. This has featured creel censuses, population sampling, and the liberation and recovery of marked fish.

Yellowstone Park; began May 1953, closed October 1956; \$4,000; Oliver B. Cope, Leader.

Address inquiries to: Oliver B. Cope, as in No. 1 above.

3. Yellowstone Lake Investigations

The objective is to determine the sizes and numbers of cutthroat trout that can be safely harvested from Yellowstone Lake under different levels of fishing pressure. This consists primarily of measurement of mortality and survival in Yellowstone Lake and its tributaries.

Yellowstone Park; began May 1950, indefinite; \$25,000; Oliver B. Cope, Leader; reports available.

Address inquiries to: Oliver B. Cope, as in No. 1 above.

ALASKA

Game Commission

1. Public Access and Development of Restoration Facilities

The objectives of this project are to spread fishing pressure and to develop fishing in remote waters by providing access.

Territory wide; began December 1952, to close January 1959; \$5,000; Roger W. Allin, Robert T. Baade, and George W. Warner, Leaders; reports available.

Address inquiries to: Clarence J. Rhode, Administrator, Wildlife Resources, Box 2021, Juneau, Alaska.

2. Environmental Studies of the Cutthroat Trout, Rainbow Trout and Grayling in Alaska as Related to Their Spawning Habits, Age, Growth, Fecundity, Migration and Movement

The objective of this project is to determine the migrations and movements of the above species of game fish in specific waters, their migration timing, growth and survival as related to their environment. Migrations of the species

are being observed by weirs, by marking and recapture, visual observations and catch data and related to environmental seasonal changes in specific waters.

Helm Bay near Ketchikan, Cottonwood Creek System near Anchorage, Goodpaster River near Fairbanks; began July 1953, to close March 1957; \$23,000; Roger W. Allin, Robert T. Baade, and George W. Warner, Leaders; reports available.

Address inquiries to: Clarence J. Rhode, as in No. 1 above.

3. Lake Survey of Lake Louise and Associated Waters

The objectives of this project are to determine morphological features of the area, chemical and physical characteristics of the water, the flora and fauna factors influencing the biota, the size and age composition of the fishery and the success of previous three years of rainbow stocking in these waters. The area involved in the study is a major recreational fishing and hunting area and presently supports a heavy fishery for lake trout and some grayling. Stocking of these waters with rainbow trout was begun in 1953 and continued through 1955 with both eyed egg and fry being used in the stocking.

Near the Glen Allen Highway; began July 1956, closed September 1956; \$1,000; Roger W. Allin, Leader; reports available.

Address inquiries to: Clarence J. Rhode, as in No. 1 above.

4. Experimental Pond Fertilization

The objective of this project is to determine whether it is feasible and economical to increase the survival and growth of trout in ponds adjacent to Juneau. Two small ponds of 3 and 5 acres have been utilized for the experiment. Rotary screens have been installed in the outlets of the ponds and both rotenoned to remove all fish. One pond is being treated with chemical fertilizer while the other was left in the natural state as a control. Both have been stocked and growth and survival of planted rainbow fry will be used to assess value of fertilizer.

Juneau; began July 1955, to close June 1957; \$2,200; Robert T. Baade, Leader; reports available.

Address inquiries to: Clarence J. Rhode, as in No. 1 above.

5. Catch Distribution, Composition and Size Structure of the Sport Fishery of the Anchorage and Fairbanks Areas

The objective of this project is to establish species catch distributions, measure size distribution and age composition, the relative catch by time, and to measure the effectiveness of experimental regulations in designated waters including 12-inch minimum size and seasonal closures for the Fairbanks district to determine best management regulations for the maintenance of optimum stock and fishing. The usefulness of present experimental regulations is to be determined. Other creel studies along the Glen Highway and Gulkana area are to evaluate present fishing in the area in relationship to the Interior Highway system and the greater Anchorage population of fishermen.

Along the Richardson and Glen Allen Highways; began April 1953, closed December 1956; \$5,400; Roger W. Allin and George W. Warner, Leader; reports available.

Address inquiries to: Clarence J. Rhode, as in No. 1 above.

6. Stocking of Game Fish in Alaska Waters.

The objective of this project is to establish or re-establish fisheries in barren waters, depleted waters or waters with unfavorable fish balances. Stocking of barren and depleted waters is preceded by standard lake and stream surveys for suitable waters.

U. S. Forest Service, Alaska Department of Fisheries and Sportsmen's Clubs cooperating; territory wide; began July 1953, continuing; \$3,100; Robert T. Baade, and Roger W. Allin, Leaders; reports available.  
Address inquiries to: Clarence J. Rhode, as in No. 1 above.

Department of Fisheries

1. Inventory of Waters

The objective is to inventory the waters of the Territory with special emphasis given to the survey and collection of biological data on lakes and streams adjacent to the highway systems. This information to be used in sport fish management.

Territory wide; began May 1951, indefinite; \$15,000; E. S. Marvich, Leader; reports available.

Address inquiries to: Alaska Department of Fisheries, 229 Alaska Office Building, Juneau, Alaska.

2. Comparative Growth and Survival Study of Planted Trout Fry

The objectives are to determine which of several stocks of rainbow trout have the greatest survival and rate of growth in rehabilitated and virgin lakes.

Anchorage and Fairbans areas; began September 1956, to close September 1959; \$2,000; E. S. Marvich, Leader.

Address inquiries to: As in No. 1 above.

3. Relationship of Stickleback and Steelhead Trout in Lakes

Experiments are being conducted on a series of six lakes to determine what effects are exerted on introduced steelhead trout fry by varied stickleback pressures. Rehabilitated lakes stocked with steelhead trout fry are included in this experiment.

Kodiak Island; began June 1956, to close June 1959; \$2,000; E. S. Marvich Leader; reports available.

Address inquiries to: As in No. 1 above.

4. Kitoi Bay Research Station

This project determines the limits of productivity of Alaskan lakes for anadromous trout and salmon. On several lakes in the area the production of fish is determined by adult and fry enumeration at the outlet weirs. Age and growth studies are related to bio-geochemical analyses.

Afognak Island; began June 1954, to close 1964; \$50,000; William A. Smoker, Leader.

Address inquiries to: As in No. 1 above.

Water Pollution Control Board

1. Silver Bay Water Pollution Control Studies

The following will be determined: (a) The present natural resources, their distribution and seasonal occurrence. (b) The types and quantities of waste which will be discharged in the operation of the pulp mill. (c) The maximum concentrations of such waste under which present natural resources may be maintained. (d) How much, where, and when this waste should be discharged in order to keep the concentration from exceeding the maximum.

U. S. Forest Service, U. S. Fish and Wildlife Service, Alaska Lumber and Pulp Co., and University of Washington cooperating; Sitka; began July 1956, indefinite; \$20,000; E. F. Eldridge and Robert O. Sylvester, Leaders; reports available.

ALASKA (Cont.)

Address inquiries to: A. J. Alter, Administrator of Water Pollution Control Board, Juneau, Alaska.

Forest Service - Alaska Forest Research Center

1. Effect of Logging on Salmon Streams

Objectives of the project are to determine the effect of logging, particularly pulp timber logging, on the physical aspects of two salmon streams before and after logging and compared with two others not logged. Factors measured are stream height and rate of flow, rainfall, water and air temperature, stream bed condition and changes in bed and banks.

U. S. Fish and Wildlife Service, Fisheries Research Institute and U. S. Geological Survey cooperating; Twelve Mile Arm, Kasaan Bay near Hollis; began April 1949, indefinite; \$15,000; H. E. Anderson, Leader; reports available.

Address inquiries to: Forester in Charge, Alaska Forest Research Center, Box 740, Juneau, Alaska.

U. S. Fish and Wildlife Service, Branch of Alaska Fisheries

1. Enumeration of Upstream Migration of Red Salmon in the Egegik River

Use of towers for enumeration of upstream migrants in the Wood River has shown considerable promise. This project is a pilot study on the Egegik River which has the advantage of a weir for a check on the accuracy of visual counts from four towers.

Egegik River, Bristol Bay; began June 1956; Harry Rietze, Leader; reports available.

Address inquiries to: Harry Rietze, U. S. Fish and Wildlife Service, Box 2021, Juneau, Alaska.

2. Stickleback Studies

The objectives are to review, analyze, and prepare for publication data on the life history of the stickleback of Karluk and bare lakes of Kodiak Island with special emphasis on their relation to salmonoid fishes.

Karluk Lake, Kodiak Island; began June 1956, closed November 1956; \$5,000; John Greenbank, Leader.

Address inquiries to: Donald L. McKernan, Administrator of Alaska Commercial Fisheries, Box 2021, Juneau, Alaska.

U. S. Fish and Wildlife Service, Office of River Basin Studies

1. River Basin Studies

The objectives of these studies are the preservation, rehabilitation and development of fish and wildlife resources in connection with water use projects and their development. Inventories, harvest studies, population evaluations and other investigations are being made.

Territory wide; began July 1952, continuing; \$70,000; Melvin A. Monson and Gordon W. Watson, Leaders.

Address inquiries to: Donald L. McKernan, Administrator, Alaska Commercial Fisheries, Box 2021, Juneau, Alaska.

Division of Fish and Game

## 1. Introduction of Exotic Marine Game and Food Fishes

Underwater surveys of inshore fishing areas have disclosed that the Hawaiian fish fauna is depauperate and unbalanced. It is dominated by small herbivorous fishes such as the surgeon fishes, butterfly fishes and damsel fishes, which have practically no recreational or commercial value. Thus, it is the objective of this project to enrich and bring about a better balance in the Hawaiian fish fauna through introduction of selected carnivorous fish species for which ecological niches are available in Hawaii from areas in the Pacific. Inasmuch as certain of the fish species being considered for introduction are reputed to be poisonous, as a corollary to this introduction program, certain poisonous fish studies are being conducted. These studies include feeding tests on experimental animals and toxin leaching experiments in which reputedly poisonous fishes are being kept under isolation on a subsistence of non-poisonous food to determine if the toxin can be metabolized or leached out of the fishes.

Economic Planning and Coordination Authority cooperating; Pacific-wide; began October 1955, indefinite; \$6,000; Michio Takata and Carl Nemoto, Leaders.

Address inquiries to: Vernon E. Brock, Director, Division of Fish and Game, Board of Commissioners of Agriculture and Forestry, P. O. Box 5425, Pawa Sub-station, Honolulu, Hawaii.

## 2. Ecological Studies of Hawaiian Reef and Inshore Game Fishes

The objectives of this project are to find and adopt corrective measures to rehabilitate the declining reef and inshore game and food fishes in the Hawaiian inshore waters. In an effort to obtain some clues as to why certain areas have an abundance of fish and others a scarcity of fish, attempts are being made to relate fish abundance with current conditions, plankton abundance, bottom types and other environmental factors. Additionally, habitat improvement experiments are being conducted on a limited scale. These involve the placing of specially designed concrete shelters in selected areas to determine what effects they might have toward increasing the standing crop of fishes in a given area.

Territory-wide; began February 1952, indefinite; \$11,000; Michio Takata and Takuji Fujimura, Leaders.

Address inquiries to: Vernon E. Brock, as in No. 1 above.

## 3. Bait Fish Studies

The principle bait fish species used in the Hawaiian skipjack fishery is the nehu (Stolephorus purpureus) which is an extremely delicate fish having a low tolerance for adverse conditions. Besides being in constant short supply, they suffer about 30 percent mortality from the time of their capture to the time when they are used out in the fishing grounds. So that the maximum benefits can be derived from the limited bait supply, these bait fish studies are aimed toward developing bait holding techniques which might result in a reduction in bait fish mortality and an increase in the carrying capacities of live wells aboard skipjack fishing vessels. Holding bait fish in water of reduced salinity, together with the use of an aerator, have resulted in a 50 percent reduction in mortality and a 60 percent increase in carrying capacity.

Industrial Research Advisory Council and Hawaiian Tuna Packers, Ltd., cooperating; Oahu; began November 1953, to close June 1957; \$1,000; Vernon Brock and Michio Takata, Leaders; reports available.

Address inquiries to: Vernon E. Brock, as in No. 1 above.

4. Propagation and Culture of Tilapia zillii and Tilapia melanopleura

Tilapia zillii and Tilapia melanopleura which were introduced recently into the Territory are being reared under close observation to determine culture methods which are most suited for these species. The feeding habits of these species indicate that they may be useful for controlling aquatic plant growth in irrigation ditches and reservoirs. The possibility also exists that these fishes may fulfil the requirements of a farm pond or game species or act as forage fish for both the largemouth and smallmouth bass.

Oahu; began August 1955, continuing; \$1,500; Kenji Ego, Leader.

Address inquiries to: Vernon E. Brock, as in No. 1 above.

5. Fresh Water Game Fish Management Research

This project which encompasses four phases has the following objectives: (a) to study the spawning habits, feeding behavior, growth rate, migrational pattern, population density and other aspects of the life history of the fresh water goby that management measures may be instituted which will best conserve this diminishing resource; (b) to re-establish rainbow trout fishing and to determine the most economical stocking method as well as the optimum number of fingerlings or eggs to be planted in the various streams; (c) to introduce and establish smallmouth bass, channel catfish and peacock-eye cichlid in suitable bodies of fresh water and; (d) to develop fish shipping techniques which can be used for introducing various species of fish into the Territory.

Kauai, Oahu, Maui and Hawaii; began November 1951, continuing; \$17,869; Kenji Ego, Carl Nemoto and Stanley Shima, Leaders.

Address inquiries to: Vernon E. Brock, as in No. 1 above.

U. S. Fish and Wildlife Service, Branch of Fishery Biology

1. Factors in the Variable Response of Skipjack to Chum

The objectives are: (1) To describe the response of skipjack schools to livebait chum; (2) to determine the amount of variability in response; (3) to find the causes of variation. Factors being investigated are state of hunger, prey preference, prey-size preference, sexual state, time, location, and weather conditions.

Honolulu; began March 1956, to close September 1957; Heeny Yuen, Leader.

Address inquiries to: Albert L. Tester, Director, Pacific Oceanic Fishery Investigations, P. O. Box 3830, Honolulu, T. H.

2. Distribution, Abundance, and Habits of Pelagic Sharks

The objectives of the study are to further our knowledge of pelagic sharks by studying their distribution, abundance, food habits, reproduction, morphology, and taxonomy. The basis for the study are the 1952-1955 longline catch records for 6,118 specimens belonging to 12 species. Three of these (great blue, whitetip, and brown) constituted 96 percent of the catch and have received the most attention. Geographical scope of the study is the Pacific Ocean from 50° N. to 20° S., and from 110° W. to 175° E.

Honolulu; began November 1955, closed November 1956; Donald W. Strasburg, Leader.

Address inquiries to: Albert L. Tester, as in No. 1 above.

Division of Forests, Fish and Wildlife

1. Puerto Rico Marine Sport Fisheries Investigations

The purpose of this project is to study the marine sport fisheries in respect to their biology and present development. The work being performed is concentrated mostly at La Parguera (Lajas) and San Juan and includes: Analysis of catch per unit of effort according to species of fish and type of angling; seasonal variation in the catch; length and weight of fishes; examination of gonads and stomach contents of important game fishes to determine the attainment of sexual maturity, spawning seasons and food habits; the number of people who engage in sportfishing and the man or boat days spent on the various methods, particularly spear fishing, surfcasting, spinning, and trolling. Another objective of this project is to study the commercial fisheries of La Parguera from the standpoint of the species taken, relative number of each, gear employed and possible effects on game fish and sport fishing.

La Parguera; began July 1955, indefinite; \$4,400; Donald S. Erdman, Leader; reports available.

Address inquiries to: Division of Forests, Fish and Wildlife, Department of Agriculture and Commerce, Santurce, Puerto Rico.

2. Introduction of Exotic Fishes to the Streams of Puerto Rico

This project has as its ultimate purpose the hope of establishing a suitable game fish in the upland river waters of Puerto Rico. A one-year survey was carried on at the Anasco River. This river is inhabited with predatory salt water fishes such as snook Centropomus and the "Viejo" Pomadasyd crocro up to El Guasio at about 300 feet above sea level. None of the predatory species, however, ascend beyond the rapids which occurs just above El Guasio. Thus, a long stretch of upper reaches of the river is uninhabited with game fishes. Similar situations occur in other rivers of Puerto Rico.

One fish which is being planned for introduction is the redeye bass Micropterus coosae which is reported to be more adaptable to river conditions.

Maricao; began November 56 continuing; \$1,200; Donald S. Erdman and Herbert Zalduondo, Leaders; reports available.

Address inquiries to: As in No. 1 above.

3. Creel Census and Fish Population Study in Farm Fish Ponds and Lakes Loiza, Carite, and Patillas

Objectives of this project are: (1) a farm fish pond survey and (2) a creel census and fish population study at Loiza, Carite and Patillas Reservoirs which will lead to a more efficient utilization and conservation of the pond and lake fisheries in Puerto Rico.

The physical characteristics and chemical conditions of at least 15 ponds into which bass and bluegills have been introduced are being studied and recorded in the following aspects: acreage, average depth of water; type and approximate gradient of bottom; pH, dissolved oxygen content and temperature of the water; types and extent of aquatic vegetation and kind of fish food present. Composition and structure of pond fish populations are being determined by seining, pond drainage, or occasional use of rotenone. Fishing by hook and line and fish pots are being used as a supplementary sampling method.

A creel census checker devotes four months work to each of the lakes Loiza, Carite and Patillas. Two biologists collect fish population samples with rotenone at least once a year.

Patillas, Trujillo Alto, Guayama, Aibonito, and Barranquitas; began July 1956; to close June 1958; \$4,400; Donald S. Erdman and Herbert Zalduondo, Leaders; reports available.

Address inquiries to: As in No. 1 above.

Government of Virgin Islands

1. Investigation of Game Fishing Potential

This project involves: (1) Exploratory fishing covering all reasonable types of sport fishing in these waters to assess over-all potential. (2) Biological investigations, including collection of specimens and compiling of data on fish sizes, distribution, and habits. (3) Public relations activities. (4) Fresh water stocking activities consisting mainly of stocking certain ponds in St. Croix with black bass and smaller species.

Christiansted, St. Croix; began April 1956, continuing; \$10,000; Frank J. Mather, III, Leader.

Address inquiries to: Frank J. Mather, III, Christiansted, St. Croix, Virgin Islands.

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